THE WISDOM OF GOD

Manifested in the

WORKS

OF THE

Creation.

Being the

Substance of some common Places delivered in the Chappel of *Trinity-College*, in *Cambridge*.

By *John Ray*, M. A. sometimes Fellow of that, and now of the *Royal Society*.

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BRITISH MUSEUM

TO THE

Much Honoured and truly Religious LADY,

THE

Lady *LETICE WENDY*

OF

Wendy in *Cambridgeſhire.*

MADAM,

TWO or three Reaſons induce me to preſent this Diſcourſe to your Ladyſhip, and to make choice of you for its Patroneſs: Firſt, becauſe I owe it to the Liberality of your Honoured Brother, that I have this leiſure to write any Thing. Secondly, Becauſe alſo your many and ſignal Favors, ſeeing I am not in a Capacity to requite them, ſeem to exact from me at leaſt a publick Acknowledgment,

knowledgment, which ſuch a Dedication gives me an Opportunity to make. Thirdly, Becauſe of ſuch kind of Writings I know not where to chuſe a more able Judge, or more candid Reader. I am ſenſible that you do ſo much abhor any thing that looks like Flattery, that out of an exceſs of Modeſty you cannot patiently bear the hearing of your own juſt Commendations, and therefore ſhould I enlarge upon that Subject, I know I ſhould have but little Thanks for my Pains.

Indeed you have much better Motives to do well, than the Praiſe of Men, the Favor of God, Peace of Conſcience, the Hope and Expectation of a future Reward of Eternal Happineſs; and therefore I had rather write of you to others, to provoke them to imitate ſo excellent an Example, than to your Self, to encourage you in your Chriſtian Courſe, and to fortifie you

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in your Athletick Conflicts with the greateſt of Temporal Evils, bodily Pain and Anguiſh; though I do not know why you ſhould reject any conſideration that may conduce to ſupport you under ſo heavy Preſſures, and of ſo long continuance; of which to ingenuous Natures true Honor, that is the concurrent Teſtimony and Approbation of good Men, is not the meaneſt. No leſs Man than S. *Auguſtine* was doubtful whether the extremity of bodily Pain, were not the greateſt Evil that Humane Nature was capable of ſuffering: Nay (ſaith he) *I was ſometimes compelled to conſent to* Cornelius Celſus, *that it was ſo, neither did his Reaſon ſeem to me abſurd; we being compounded of two Parts, Soul and Body, of which the firſt is the better, the latter the worſer, the greateſt Good muſt be the beſt thing belonging to the better Part, that is Wiſdom, and the greateſt Evil the worſt thing incident to the wor-*

ſer Part (the Body) that is Pain. Now though I know not whether this Reaſon be firm and concluſive, yet I am of accord with him, that of all the Evils we are ſenſible of in this World it is the Soreſt; the moſt reſolute Patience being baffled and proſtrated by a fierce and laſting Paroxyſm of the Gout or Stone, or Colick, and compelled to yield to its furious Inſults, and confeſs itſelf vanquiſhed, the Soul being unable to divert, or to do any thing elſe but pore upon the Pain. And therefore thoſe Stoical vaunts of their Wiſe Mans being happy in *Perillus* his Bull, I utterly reject and explode, as vain Rhodomontades and Chimerical Figments, for that there never was ſuch a wiſe Man among them, nor indeed could be; Yet do I not ſay, that the Patience of a good Man can be ſo far conquered by the ſharpeſt and ſevereſt Torments as to be compelled to deny or blaſpheme God or his Religion, yea

or

or so much as to complain of his Injustice, though perchance he may be brought with *Job* to curse his Day, yet not to curse his God, as his Wife tempted him to do.

Now that the great Ἀγωνοθέτης and Βραβευτὴς, the most just Judg and Rewarder would be pleas'd so to qualifie and mitigate your Sufferings as not to exceed the measure of your Strength and Patience, or else arm you with such an high Degree of Christian Fortitude, as to be able to grapple with the most extreme, and when you have finished your Course in this World, grant you a placid and easie Passage out of it, and dignifie you as one of his Victors, with a Crown of Eternal Glory and Felicity, is the Prayer of,

Madam,

Your Ladyships most devoted

in all Service,

John Ray.

The

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THE PREFACE.

IN all Ages wherein Learning hath Flouriſhed, complaint hath been made of the Itch of Writing, and the multitude of worthleſs Books, wherewith importunate Scribblers have peſtered the World, Scribimus indocti doctiq; : *And*----tenet inſanabile multos Scribendi Cacoethes. *I am ſenſible that this Tractate may likely incur the Cenſure of a ſuperfluous Piece, and my ſelf the blame of giving the Reader unneceſſary Trouble, there having been ſo much, ſo well written of this Subject by the moſt Learned Men of our time;* *Dr.* More, *Dr.* Cudworth, *Dr.* Stillingfleet *now Biſhop of* Worceſter, *Dr.* Parker, *late of* Oxon, *and to name no more the Honourable* Robert Boyl, *Eſquire, ſo that it will need ſome Apology.* Firſt *therefore, in excuſe of it I plead, That there are in it ſome Conſiderations new and untoucht by others:*

wherein

wherein if I be miſtaken, I alledge Secondly, *That the manner of Delivery and Expreſſion may be more ſuitable to ſome Mens Apprehenſion, and facile to their Underſtandings. If that will not hold, I pretend* Thirdly, *That all the particulars contained in this Book, cannot be found in any one Piece known to me, but lye ſcattered and diſperſed in many, and ſo this may ſerve to relieve thoſe Faſtidious Readers, that are not willing to take the pains to ſearch them out: and poſſibly, there may be ſome whoſe Ability (whatever their Induſtry might be) will not ſerve them to purchaſe, nor their opportunity to borrow thoſe Books, who yet may ſpare Money enough to buy ſo inconſiderable a Trifle. If none of theſe Excuſes ſuffice to acquit me of blame, and remove all prejudice, I have two further Reaſons to offer, which I think will reach home, and juſtify this Undertaking.* First, *That all Men who preſume to Write, at leaſt whoſe Writings the Printers will venture to publiſh, are of ſome Note in the World, and where they do or have Lived and Converſed, have ſome Sphere of Friends and Acquaintants, that Know and Eſteem them, who it's likely will buy any Book they ſhall Write, for the Authors ſake, who otherwiſe, would have read none of that Subject, though ten times better; and ſo the*

Book,

Book, however inferiour to what have been already Publiſhed, may happen to do much good. Secondly, *By Vertue of my Function, I ſuſpect my ſelf to be obliged to Write ſomething in Divinity, having Written ſo much on other Subjects: For being not permitted to ſerve the Church with my Tongue in Preaching, I know not but it may be my Duty to ſerve it with my Hand by Writing. And I have made choice of this Subject as thinking my ſelf beſt qualified to Treat of it. If what I have now Written ſhall find ſo Favourable Acceptance, as to Encourage me to proceed, God granting Life and Health, the Reader may expect more: if otherwiſe, I muſt be content to be laid aſide as uſeleſs, and ſatisfie my ſelf in having made this Experiment.*

As for this Diſcourſe, it is the Subſtance of ſome Common Places (*ſo in the Univerſity of* Cambridge, *they call their Morning Divinity Exerciſes*) *delivered in* Trinity-College *Chappel, when I was Fellow of that Society; which I have enlarged with the Addition of ſome Collections out of what hath been ſince Written by the forementioned Authors upon my Subject. I have been careful to admit nothing for matter of Fact or Experiment but what is undoubtedly true, leſt I ſhould build upon a Sandy and Ruinous Foun-*

Foundation; and by the admixture of what is False, render that which is True, ſuſpicious.

I might have added many more Particulars, nay, my Text warrants me to run over all the viſible Works of God in particular, and to Trace the Footſteps of his Wiſdom in the Compoſition, Order, Harmony, and Uſes of every one of them, as well as of thoſe that I have Selected. But Firſt, This would be a Task far tranſcending my Skill and Abilities; nay, the joynt Skill and Endeavours of all men now living, or that ſhall live after a Thouſand Ages, ſhould the World laſt ſo long. For no Man can find out the Work that God maketh from the beginning to the end. *Eccleſ.* 3. 11. *Secondly, I was willing to Conſult the Infirmity of the Reader, or indeed of Mankind in general, which after a ſhort confinement to one ſort of Diſh, is apt to loath it, though never ſo wholeſome, and which at firſt was moſt pleaſant and acceptable: and ſo to moderate my Diſcourſe, as to make an end of Writing before he ſhould be quite tired with Reading.*

I ſhall now add a word or two concerning the Uſefulneſs of the Argument or Matter of this Diſcourſe, and the Reaſon I had to make Choice of it, beſides what I have already mentioned.

First, *The Belief of a Deity being the Foundation of all Religion;* (*Religion being*

being nothing but a devout Worſhipping of God, or an inclination of Mind to Serve and Worſhip him;) For he that cometh to God, muſt believe that he is: *it is a Matter of the higheſt Concernment to be firmly Settled and Eſtabliſhed in a full Perſwaſion of this main Point: Now this muſt be Demonſtrated by Arguments drawn from the Light of Nature, and Works of the Creation. For as all other Sciences, ſo Divinity proves not, but ſuppoſes its Subject, taking it for granted, that by natural Light, Men are ſufficiently convinced of the being of a Deity. There are indeed ſupernatural Demonſtrations of this fundamental Truth, but not common to all Perſons or Times, and ſo liable to Cavil and Exception by Atheiſtical Perſons, as inward Illuminations of Mind, a Spirit of Prophecy and fore-telling future Contingents, Illuſtrious Miracles and the like. But theſe Proofs taken from Effects and Operations, expoſed to every Mans view, not to be denied or queſtioned by any, are moſt effectual to convince all that deny or doubt of it. Neither are they only convictive of the greateſt and ſubtleſt Adverſaries, but intelligible alſo to the meaneſt Capacities. For you may hear illiterate Perſons of the loweſt Rank of the Commonalty affirming, that they need no Proof of the being of a God, for that every Pile of Graſs,*

or

or Ear of Corn, ſufficiently proves that. For, ſay they, All the men of the World cannot make ſuch a thing as one of theſe; and if they cannot do it, who can, or did make it but God? To tell them that it made it ſelf, or ſprung up by chance, would be as ridiculous as to tell the greateſt Philoſopher ſo.

Secondly, *The particulars of this Diſcourſe, ſerve not only to Demonſtrate the being of a Deity, but alſo to illuſtrate ſome of his principal Attributes, as namely his Infinite Power and Wiſdom. The vaſt multitude of Creatures, and thoſe not only ſmall but immenſely great: The Sun and Moon, and all the Heavenly Hoſt, are Effects and Proofs of his Almighty Power.* The Heavens declare the Glory of God, and the Firmament ſheweth his handy Work, *Pſal.* 19. 1. *The admirable Contrivance of all and each of them, the adapting all the parts of Animals to their ſeveral uſes: The Proviſion that is made for their Suſtenance, which is often taken notice of in Scripture, Pſal.* 145. 15, 16. The Eyes of all wait upon thee, thou giveſt them their Meat in due ſeaſon. Thou openeſt thy Hand and ſatisfieſt the deſire of every living thing. *Matth.* 6. 26. Behold the Fowls of the Air: for they ſow not, neither do they reap, nor gather into Barns; yet your Heavenly Father feedeth them. *Pſalm.* 147. 9.

He

He giveth to the Beaſt his food, and to the young Ravens when they cry: *And Laſtly, Their mutual ſubſerviency to each other, and unanimous conſpiring to promote and carry on the publick Good, are evident Demonſtrations of his Sovereign Wiſdom.*

Laſtly, *They ſerve to Stir up and Increaſe in us the Affections and Habits of Admiration, Humility and Gratitude.* Pſalm 8. 3. When I conſidered the Heavens the Work of thy Fingers, the Moon and the Stars which thou haſt ordained; What is man that thou art mindful of him, or the Son of man that thou viſiteſt him? *And to theſe purpoſes the Holy Pſalmiſt is very frequent in the Enumeration and Conſideration of theſe Works, which may warrant me in doing the like, and juſtifie the denominating ſuch a Diſcourſe as this, rather Theological than Philoſophical.*

THE

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THE

Pſalm 104. 24.

How Manifold are thy Works O Lord? In Wiſdom haſt thou made them all.

IN theſe Words are two Clauſes, in the firſt whereof the Pſalmiſt admires the Multitude of God's works, *How Manifold are thy Works O Lord?* In the ſecond he celebrates his Wiſdom in the creation of them; *In Wiſdom haſt thou made them all.*

Of the firſt of theſe I ſhall ſay little, only briefly run over the Works of this viſible world, and give ſome gueſs at the Number of them. Whence it will appear, that upon this account they well deſerve Admiration, the Number of them being uninveſtigable by us; and ſo affording us a demonſtrative Proof of the unlimited extent of the Creators Skill, and the fœcundity of his Wiſdom and Power. That the Number of corporeal Creatures is unmeaſurably great, and known only to the Creator himſelf, may thus probably be collected: Firſt of all, The Number of fixt Stars is on all hands acknowledged to be next to infinite; Secondly, Every fixt Star in the now

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received *Hypotheſis* is a Sun or Sunlike body, and in like manner encircled with a *Chorus* of Planets moving about it; Thirdly, Each of theſe Planets is in all likelihood furniſhed with as great variety of corporeal Creatures animate and inanimate as the Earth is, and all as different in Nature as they are in Place from the terreſtrial, and from each other. Whence it will follow that theſe muſt be much more infinite than the Stars; I do not mean abſolutely according to the Philoſophick exactneſs infinite, but only infinite or innumerable as to us, or their number prodigiouſly great.

That the fixt Stars are innumerable may thus be made out: Thoſe viſible to the naked Eye are by the leaſt account acknowledged to be above a Thouſand, excluding thoſe towards the South Pole which are not viſible in our Horizon: Beſides theſe, there have been incomparably more detected and brought to light by the Teleſcope; the Milky Way being found to be (as was formerly conjectured) nothing but great Companies or Swarms of minute Stars ſingly inviſible, but by reaſon of their proximity mingling and confounding their Lights and appearing like lucid Clouds. And it's likely that, had we more perfect Teleſcopes, many Thouſands more might be diſcovered; and

yet

yet after all an incredible Multitude remain, by reaſon of their immenſe diſtance beyond all Ken by the beſt Teleſcopes that could poſſibly be invented or poliſhed by the Wit and Hand of an Angel. For if the World be, as *Des Cartes* would have it, indefinitely extended; that is, ſo far as no Human Intellect can fancy any bounds of it, then what we ſee or can come to ſee muſt be the leaſt part of what is undiſcoverable by us; the whole Univerſe extending a Thouſand times farther beyond the utmoſt Stars we can poſſibly deſcry, than thoſe be diſtant from the Earth we live upon. This *Hypotheſis* of the fixt Stars being ſo many Suns, &c. ſeems more agreeable to the Divine Greatneſs and Magnificence: But that which induces me much to doubt of the Magnitude of the Univerſe and immenſe Diſtance of the fixed Stars, is the ſtupendious *Phænomena* of Comets, their ſudden accenſion or appearance in full Magnitude, the length of their Tails and ſwiftneſs of their Motion, and gradual diminution of Bulk and Motion, till at laſt they diſappear: Neither do I think the Univerſe indefinitely extended, as *Des Cartes* upon a falſe ground [that the *formal ratio* of a Body was nothing but Extenſion into length, breadth and profundity, or having *partes extra partes*, and that Body

and Space were ſynonimous terms] aſſert ed: For it may as well be limited this way as in the old *Hypotheſis*; which places the fixt Stars in the ſame ſpherical *Superficies*; according to which (old *Hypotheſis*) they may alſo be demonſtrated by the ſame *mediums* to be innumerable, only inſtead of their diſtance ſubſtituting their Smalneſs for the reaſon of their Inviſibility.

But leaving the *celeſtial* Bodies, I come now to the *terreſtrial*; which are either *inanimate* or *animate*. The *inanimate* are the *Elements, Meteors and Foſſils* of all ſorts, at the Number of which laſt I cannot give any probable gueſs; Bur if the rule, which ſome conſiderate Philoſophers deliver, holds good; *viz.* how much more imperfect any *Genus* or Order of Beings is, ſo much more numerous are the *Species* contained under it; as for Example: Birds being a more perfect kind of Animals than Fiſhes, there are more of theſe than of thoſe, and for the like reaſon more Birds than Quadrupeds, and more Inſects than of any of the reſt; and ſo more Plants than Animals: Nature being more ſparing in her more excellent Productions. If this Rule I ſay holds good; then ſhould there be more *Species* of *Foſſils* or generally of *inanimate* Bodies than of *Vegetables*; of which there is ſome reaſon to doubt. unleſs we will admit

mit all ſorts of formed Stones to be diſtinct *Species*.

Animate Bodies are divided into four great *Genera* or Orders, *Beaſts*, *Birds*, *Fiſhes and Inſects*.

The *Species* of *Beaſts*, including alſo *Serpents*, are not very numerous: Of ſuch as are certainly known and deſcribed I dare ſay not above 150. And yet I believe not many, that are of any conſiderable bigneſs, in the known Regions of the World, have eſcaped the Cognizance of the curious. [I reckon all Dogs to be of one *Species* they mingling together in generation, and the breed of ſuch Mixtures being prolifick.]

The number of *Birds* known and deſcribed may be near 500; And the number of *Fiſhes*, ſecluding Shelfiſh as many; but if the Shelfiſh be taken in, more than double the number. How many of each *Genus* remain yet undiſcovered one cannot certainly nor very nearly conjecture, but we may ſuppoſe the whole ſum of Beaſts and Birds to exceed by a third part, and Fiſhes by one half, thoſe known.

The *Inſects*, if we take in the Exanguious both Terreſtrial and Aquatick, may in derogation to the precedent Rule for number vie even with Plants themſelves. For the *Exanguious* alone, by what that Learn-

ed and Critical Naturaliſt my Honoured Friend Dr. *Martin Liſter* hath already obſerved and delineated, I conjecture, cannot be fewer than 1800 or 2000 *Species*, perhaps many more.

The *Butterflies* and *Beetles* are ſuch numerous Tribes, that I believe in our own native Country alone the *Species* of each kind may amount to 150 or more. And if we ſhould make the *Caterpillers* and *Hexapods* from whence theſe come to be diſtinct *Species*, as moſt Naturaliſts have done, the number will be doubled, and theſe two *Genera* will afford us 600 *Species*. But if thoſe be admitted for diſtinct *Species*, I ſee no reaſon but their *Aureliæ* alſo may pretend to a Specifick difference from the *Caterpillers* and *Butterflies*; and ſo we ſhall have 300 *Species* more, therefore we exclude both theſe from the degree of *Species*, making them to be the ſame Inſect under a different *larva* or Habit.

The *Fly-kind*, if under that name we comprehend all other flying Inſects, as well ſuch as have four as ſuch as have but two Wings, of Both which kinds there are many ſubordinate *Genera*, will be found in multitude of *Species* to equal if not exceed both the forementioned kinds.

The *creeping Inſects* that never come to be

be winged, though for number they may fall ſhort of the flying or winged, yet are they alſo very numerous; as by running over the ſeveral kinds I could eaſily demonſtrate: Suppoſing then, there be a thouſand ſeveral ſorts of Inſects in this Iſland and the Sea near it: if the ſame Proportion holds between the Inſects native of England, and thoſe of the reſt of the World, as doth between Plants Domeſtick and Exotick, (that is, as I gueſs, near a Decuple) the *Species* of Inſects in the whole Earth (Land and Water) will amount to 10000, and I do believe they rather exceed than fall ſhort of that ſum. The number of Plants contained in C. *Bauhin*'s *Pinax* is about 6000, which are all that had been deſcribed by the Authors that wrote before him, or obſerved by himſelf; in which Work, beſides miſtakes and repetitions incident to the moſt wary and knowing men in ſuch a Work as that; there are a great many, I might ſay ſome Hundreds put down for different *Species*, which in my Opinion are but accidental Varieties: Which I do not ſay to detract from the excellent pains and performance of that Learned, Judicious and Laborious Herbariſt, or to defraud him of his deſerved Honour, but only to ſhew, that he was too much ſway'd by the Opinions then gene-

rally current among Herbariſts, that different Colour or multiplicity of Leaves in the Flower and the like accidents were ſufficient to conſtitute a Specifick difference. But ſuppoſing there had been 6000 then known and deſcribed; I cannot think but that there are in the World more then double that number; there being in the vaſt continent of *America* as great a variety of *Species* as with us, and yet but few common to *Europe*, or perhaps *Africk* and *Aſia*, and if, on the other ſide the Equator, there be much Land ſtill remaining undiſcovered as probably there may, we muſt ſuppoſe the number of Plants to be far greater.

What can we infer from all this? If the number of Creatures be ſo exceeding great, how great nay immenſe muſt needs be the Power and Wiſdom of him who form'd them all! For (that I may borrow the Words of a Noble and Excellent Author) as it argues and manifeſts more ſkill by far in an Artificer to be able to frame both *Clocks and Watches, and Pumps, and Mills, and Granadoes and Rockets,* then he could diſplay in making but one of thoſe ſorts of Engines; ſo the Almighty diſcovers more of his Wiſdom in forming ſuch a vaſt multitude of different ſorts of Creatures, and all with admirable and irreproveable Art, than

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if he had created but a few: For this declares the greatneſs and unbounded Capacity of his Underſtanding. Again, the ſame ſuperiority of Knowledg would be diſplaid by contriving Engines of the ſame kind or for the ſame purpoſes after different faſhions, as the moving of Clocks or other Engines by Springs inſtead of Weights: So the Infinitely Wiſe Creator hath ſhewn in many Inſtances, that he is not confin'd to one only Inſtrument for the working one Effect, but can perform the ſame thing by divers means. So though Feathers ſeem neceſſary for flying, yet hath he enabled ſeveral Creatures to fly without them, as two ſorts of Fiſhes, and the Bat, not to mention the numerous tribes of flying Inſects. In like manner though the Air-bladder in Fiſhes ſeems neceſſary for ſwimming, yet ſome are ſo form'd as to ſwim without it; *viz.* Firſt, The *Cartilagineous* kind, which by what artifice they poiſe themſelves, aſcend and deſcend at pleaſure, and continue in what depth of Water they liſt, is as yet unknown to us. Secondly, The *Cetaceous* kind, or Sea-Beaſts differing in nothing almoſt from Quadrupeds but the want of Feet. The Air which in reſpiration theſe receive into their Lungs may ſerve to render their Bodies equiponderant to the Water; and the

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conſtriction or dilatation of it, by the help of the Diaphragm and Muſcles of reſpiration, may probably aſſiſt them to aſcend or deſcend in the Water, by a light impulſe thereof with their Fins.

Again, though the Water being a cold Element, the moſt wiſe God hath ſo attempered the blood and bodies of Fiſhes in general, that a ſmall degree of heat is ſufficient to preſerve their due conſiſtency and motion and to maintain Life; yet to ſhew that he can preſerve a Creature in the Sea, and in the coldeſt part of the Sea too, that may have as great a degree of heat as *Quadrupeds* themſelves; he hath created great variety of theſe Cetaceous Fiſhes, which converſe chiefly in the Northern Seas, whoſe whole Body being encompaſſed round with a copious Fat or Blubber (which, by reflecting and redoubling the internal heat, and keeping off the external cold, doth the ſame thing to them that Cloths do to us) is enabled to abide the greateſt cold of the Sea-water. The reaſon why theſe Fiſhes delight to frequent chiefly the Northern-Seas is I conceive not only for the quiet which they enjoy there, but becauſe the Northern Air, which they breath being more fully charged with nitrous particles, is fitteſt to maintain the vital Heat in that Activity as

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is ſufficient to move ſuch an unwieldy bulk, as their Bodies are with due celerity and to bear up againſt and repell the ambient cold; and may likewiſe enable them to continue longer under water than a warmer and thinner Air could.

I come now to the ſecond part of the words; *In Wiſdom haſt thou made them all.* In diſcourſing wherof I ſhall endeavour to make out in particulars what the Pſalmiſt here aſſerts in general concerning the works of God, that they are all very wiſely contrived and adapted to ends both Particular and General.

But before I enter upon this task, I ſhall, by way of Preface or Introduction, ſay ſomething concerning thoſe Syſtems which undertake to give an Account of the formation of the Univerſe by Mechanical *Hypotheſes* of Matter moved either uncertainly, or according to ſome Catholick Laws, without the intervention and aſſiſtance of any ſuperior immaterial Agent.

There is no greater, at leaſt no more palpable and convincing Argument of the Exiſtence of a Deity than the admirable Art and Wiſdom that diſcovers itſelf in the make and conſtitution, the order and diſpoſition, the ends and uſes of all the parts and members of this ſtately fabrick of Hea-

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ven and Earth. For if in the works of Art, as for example; a curious Edifice or Machine, counſel, deſign, and direction to an end appearing in the whole frame and in all the ſeveral pieces of it, do neceſſarily infer the being and operation of ſome intelligent Architect or Engineer, why ſhall not alſo in the Works of Nature, that Grandeur and Magnificence, that excellent contrivance for Beauty, Order, Uſe, *&c.* which is obſervable in them, wherein they do as much tranſcend the Effects of human Art as infinite Power and Wiſdom exceeds finite, infer the exiſtence and efficiency of an Omnipotent and All-wiſe Creator?

To evade the force of this Argument, and to give ſome Account of the Original of the World, Atheiſtical Perſons have ſet up two *Hypotheſes.*

The firſt is that of *Ariſtotle*, that the World was from Eternity, in the ſame condition that now it is, having run through the Succeſſions of infinite generations; to which they add, Self-exiſtent and unproduced. For *Ariſtotle* doth not deny God to be the *efficient Cauſe* of the World. But only aſſerts, that he created it from Eternity making him a neceſſary Cauſe thereof; it proceeding from him by way of Emanation, as light from the Sun.

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This *Hypotheſis* which hath ſome ſhew of reaſon, for ſomething muſt neceſſarily exiſt of it ſelf; and if ſomething, why may not all things? This *Hypotheſis*, I ſay, is ſo clearly and fully confuted by the Reverend and Learned Dr. *Tillotſon* now Dean of S. *Pauls London*, in his firſt printed Sermon, and the R. Reverend Father in God *John* late Lord Biſhop of *Cheſter* in Book I. Chap. V. of his Treatiſe of the *Principles of Natural Religion*, that nothing material can by me be added; to whom therefore I refer the Reader.

The Epicurean Hypotheſis *rejected.*

The ſecond *Hypotheſis* is that of the *Epicureans*, who held that there were two Principles ſelf-exiſtent: Firſt, Space or Vacuity; Secondly, Matter or Body; both of infinite Duration and Extenſion. In this infinite Space or Vacuity, which hath neither beginning nor end, nor middle, no limits or extremes, innumerable minute Bodies into which the Matter was divided called *Atomes*, becauſe by reaſon of their perfect ſolidity they were really indiviſible (for they hold no body capable of Diviſion, but what hath Vacuities interſperſt with Matter) of various but a determinate number of Figures, and equally ponderous do perpendicularly deſcend, and by their

their fortuitous concourſe make compound Bodies, and at laſt the World it ſelf. But now, becauſe if all theſe Atomes ſhould deſcend plum down with equal Velocity, as according to their Doctrine they ought to do, (being as we ſaid) all perfectly ſolid and imporous, and the *vacuum* not reſiſting their motion, they would never the one overtake the other, but like the drops of a Shower would always keep the ſame diſtances, and ſo there could be no Concourſe or Cohæſion of them, and conſequently nothing created; partly to avoid this deſtructive conſequence, and partly to give ſome account of the Freedom of Will (which they did aſſert contrary to the *Democritick* Fate) they did abſurdly feign a declination of ſome of theſe Principles, without any ſhadow or pretence of Reaſon. The former of theſe motives you have ſet down by * *Lucretius* in theſe Words:

* *De Nat. rerum.* l. 2.

Corpora cum deorſum rectum per inane ferun-
tur
Ponderibus propriis, incerto tempore fortè,
Incertiſq; locis, Spatio diſcedere paulùm;
Tantum quod momen mutatum dicere poſſis.

And again;

Quòd niſi declinare ſolerent, omnia deorſum
Imbris uti guttæ caderent per inane pro-
fundum,

Nec

Nec foret offenſus natus, nec plaga creata
Principiis, ita nil unquam natura creâſſet.

The ſecond motive they had to introduce this gratuitous Declination of Atomes, the ſame Poet gives us in theſe Verſes, *Lib.* 2.

—Si ſemper motus connectitur omnis,
Et vetere exoritur ſemper novus ordine certo;
Nec declinando faciunt primordia motûs
Principium quoddam quod fati fœdera rumpat,
Ex infinito ne cauſam cauſa ſequatur;
Libera per terras unde hæc animantibus extat,
Unde hæc eſt, inquam, fatis avolſa voluntas?

The folly and unreaſonableneſs of this ridiculous and ungrounded Figment, I cannot better diſplay and reprove than in the Words of *Cicero*, in the beginning of his firſt Book *de finibus Bonorum & Malorum.* This Declination (ſaith he) is altogether childiſhly feigned, and yet neither doth it at all ſolve the difficulty, or effect what they deſire. For firſt they ſay the Atomes decline, and yet aſſign no reaſon why. Now nothing is more ſhameful and unworthy a Natural Philoſopher [*turpius Phyſico*] than to aſſert any thing to be done without a Cauſe, or to give

give no reaſon of it. Beſides this is contrary to their own *Hypotheſis* taken from ſence, that all Weights do naturally move perpendicularly downward. Secondly, Again ſuppoſing this were true, and that there were ſuch a Declination of Atomes, yet will it not effect what they intend. For either they do all decline, and ſo there will be no more concourſe than if they did perpendicularly deſcend; or ſome decline, and ſome fall plum down, which is ridiculouſly to aſſign diſtinct Offices and Tasks to the Atomes, which are all of the ſame nature and ſolidity. Again, in his Book *de Fato* he ſmartly derides this fond conceit thus; What cauſe is there in Nature which turns the Atomes aſide? Or do they caſt Lots among themſelves which ſhall decline, which not? Or why do they decline the leaſt interval that may be, and not a greater? Why not two or three *minima* as well as one? *Optare hoc quidem eſt non diſputare,* For neither is the Atome by any extrinſecal impulſe diverted from its natural courſe; neither can there be any cauſe imagined in the Vacuity through which it is carried why it ſhould not move directly; neither is there any change made in the Atome it ſelf, that it ſhould not retain the motion natural to it, by force of its weight or Gravity.

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As for the whole *Atomical Hypotheſis*, either *Epicurean* or *Democritick*, I ſhall not, nor need I ſpend time to confute it; this having been already ſolidly and ſufficiently done by many learned men, but eſpecially Dr. *Cudworth* in his *Intellectual Syſtem of the Univerſe*, and the preſent Biſhop of *Worceſter* Dr. *Stillinfleet* in his *Origines Sacræ*. Only I cannot omit the *Ciceronian* Confutation thereof, which I find in the place firſt quoted, and in his firſt and ſecond Books *de Naturâ Deorum*, becauſe it may ſerve as a general Introduction to the following particulars. Such a turbulent concourſe of Atomes could never (ſaith he) *hunc mundi ornatum efficere*, compoſe ſo well ordered and beautiful a ſtructure as the World is; which therefore both in *Greek* and *Latine* hath from thence [*ab ornatu & munditie*] obtain'd its name. And again moſt fully and appoſitely in his ſecond *De Nat. Deorum*. If the Works of *Nature* are better, more exact and perfect than the Works of *Art*, and *Art* effects nothing without Reaſon; neither can the Works of *Nature* be thought to be effected without Reaſon. For is it not abſurd and incongruous? that when thou beholdeſt a Statue or curious Picture, thou ſhouldeſt acknowledg that Art was uſed to the making of it; or when thou ſeeſt the courſe of a Ship upon the Waters,

thou shouldest not doubt but the motion of it is regulated and directed by Reason and Art; or when thou considerest a Sun-Dial or Clock, thou shouldst understand presently, that the hours are shewn by Art and not by Chance; and yet imagine or believe, that the World which comprehends all these Arts and Artificers was made without Counsel or Reason. If one should carry into *Scythia* or *Britain* such a Sphere as our Friend *Posidonius* lately made, each of whose Conversions did the same thing in the *Sun* and *Moon* and other five *Planets*, which we see effected every night and day in the Heavens, who among those Barbarians would doubt that that Sphere was composed by Reason and Art? A wonder then it must needs be, that there should be any man found so stupid and forsaken of reason as to persuade himself, that this most beautiful and adorned World was or could be produced by the fortuitous concourse of Atomes. He that can prevail with himself to believe this, I do not see why he may not as well admit, that if there were made innumerable Figures of the 21 Letters in Gold, suppose, or any other Metal, and these well shaken and mixt together, and thrown down from some high place to the ground, they when they lighted upon the Earth would be so disposed

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and ranked, that a man might ſee and read in them *Ennius*'s *Annals*; whereas it were a great chance if he ſhould find one Verſe thereof among them all. For if this concourſe of Atomes could make a whole World, why may it not ſometimes make, and why hath it not ſomewhere or other in the Earth made a Temple, or a Gallery, or a *Portico*, or a Houſe, or a City? Which yet it is ſo far from doing, and every man ſo far from believing; that ſhould any one of us be caſt, ſuppoſe, upon a deſolate *Iſland*, and find there a magnificent Palace artificially contrived according to the exacteſt rules of Architecture, and curiouſly adorned and furniſhed; it would never once enter into his head, that this was done by an Earthquake, or the fortuitous ſhuffling together of its component Materials; or that it had ſtood there ever ſince the conſtruction of the World, or firſt cohæſion of Atomes: But would preſently conclude that there had been ſome intelligent Architect there, the effect of whoſe Art and Skill it was. Or ſhould he find there but upon one ſingle ſheet of Parchment or Paper an Epiſtle or Oration written, full of profound Senſe, expreſſed in proper and ſignificant Words, illuſtrated and adorned with elegant Phraſe; it were beyond the Poſſibility of the Wit of man to perſwade him

that this was done by the temerarious daſhes of an unguided Pen, or by the rude ſcattering of Ink upon the Paper, or by the lucky projection of ſo many Letters at all adventures; but he would be convinced by the evidence of the thing at firſt ſight, that there had been not only ſome man, but ſome Scholar there.

The Carteſian Hypotheſis *conſidered and cenſured.*

Having rejected this *Atheiſtick Hypotheſis* of *Epicurus* and *Democritus*, I ſhould now proceed to give particular inſtances of the Art and Wiſdom clearly appearing in the ſeveral Parts and Members of the Univerſe; from which we may juſtly infer this general concluſion of the Pſalmiſt, *In Wiſdom haſt thou made them all*: But that there is a ſort of profeſſed *Theiſts*, I mean Monſ. *Des Cartes* and his followers, who endeavour to diſarm us of this decretory Weapon; to evacuate and exterminate this Argument which hath been ſo ſucceſsful in all Ages to demonſtrate the exiſtence, and enforce the belief of a Deity; and to convince and ſilence all Atheiſtick Gainſayers. And this they doe,

Firſt, By excluding and baniſhing all conſideration of final Cauſes from Natural Philoſophy;

loſophy; upon pretence, that they are all and every one in particular undiſcoverable by us; and that it is raſhneſs and arrogance in us to think we can find out God's Ends and be partakers of his Counſels. *Atque ob hanc unicam rationem totum illud cauſarum genus quod à fine peti ſolet, in rebus Phyſicis nullum uſum habere exiſtimo; non enim abſq; temeritate me puto inveſtigare poſſe fines Dei.* Medit. Metaph. And again in his *Principles* of *Philoſophy*, *Nullas unquam rationes circa res Naturales à fine quem Deus aut Natura in iis faciendis ſibi propoſuit admittimus, quia non tantum nobis debemus arrogare ut ejus Conſiliorum participes eſſe poſſimus.* And more expreſly in his fourth Anſwer, *viz.* to *Gaſſendus*'s Objections; *Nec fingi poteſt, aliquos Dei fines magis quàm alios in propatulo eſſe: omnes enim in imperſcrutabili ejus Sapientiæ abyſſo ſunt eodem modo reconditi*; that is, neither can or ought we to feign or imagine, that ſome of God's Ends are more manifeſt than others; for all lie in like manner or equally hidden in the unſearchable abyſs of his Wiſdom.

This confident Aſſertion of *Des Cartes* is fully examined and reproved by that honourable and excellent Perſon Mr. *Boyl*, in his *Diſquiſition about the final Cauſes of Natural Things*, Sect. 1. from Pag. 10. to the

end: And therefore I shall not need say much to it; only in brief this, that it seems to me false and of evil consequence, as being derogatory from the glory of God, and destructive of the acknowledgment and belief of a Deity:

For first, Seeing, for instance, That the Eye is employed by Man and all Animals for the use of Vision, which, as they are framed, is so necessary for them, that they could not live without it; and God Almighty knew that it would be so; and seeing it is so admirably fitted and adapted to this use, that all the Wit and Art of men and Angels could not have contrived it better, if so well; it must needs be highly absurd and unreasonable to affirm, either that it was not designed at all for this use, or that it is impossible for man to know whether it was or not.

Secondly, How can Man give thanks and praise to God for the use of his Limbs and Senses and those his good Creatures which serve for his sustenance; when he cannot be sure they were made in any respect for him; nay, when 'tis as likely they were not, and that he doth but abuse them to serve ends for which they never intended.

Thirdly, This Opinion, as I hinted before, supersedes and cassates the best *medium* we have

have to demonſtrate the Being of a Deity; leaving us no other demonſtrative Proof but that taken from the innate *Idea*; which, if it be a Demonſtration, is but an obſcure one, not ſatisfying many of the learned themſelves, and being too ſubtle and metaphyſical ro be apprehended by vulgar Capacities, and conſequently of no force to perſuade and convince them.

Secondly, They endeavour to evacuate and diſanul our great Argument, by pretending to ſolve all the *Phænomena* of Nature, and to give an Account of the Production and Efformation of the Univerſe, and all the corporeal Beings therein, both celeſtial and terreſtrial as well animate as inanimate, not excluding Animals themſelves by a ſleight *Hypotheſis* of matter ſo and ſo divided and moved. The *Hypotheſis* you have in *Des Cartes*'s *Principles of Philoſophy*, Part. 2. *all the matter of this viſible World is* by him ſuppoſed *to have been at firſt divided by God into Parts nearly equal to each other, of a mean ſize*, viz. *about the bigneſs of thoſe whereof the Heavenly Bodies are now compounded; all together having as much motion as is now found in the World; and theſe to have been equally moved ſeverally every one by itſelf about its own Center, and among one another, ſo as to compoſe a fluid body; and alſo ma-*

ny of them jointly or in company, about ſeveral other points ſo far diſtant from one another, and in the ſame manner diſpoſed as the Centres of the fixt Stars now are. So that God had no more to do than to create the matter, divide it into parts, and put it into motion according to ſome few Laws, and that would of itſelf produce the World and all Creatures therein.

For a Confutation of this *Hypotheſis*, I might refer the Reader to Dr. *Cudworth*'s Syſtem *p.* 603. 604. but for his eaſe I will tranſcribe the words: ——— "God in the mean time ſtanding by as an Idle Spectator of this *Luſus Atomorum*, this ſportfull Dance of *Atoms*, and of the various reſults thereof. Nay theſe *mechanick Theiſts* have here quite outſtripped and outdone the *Atomick Atheiſts* themſelves, they being much more extravagant then ever thoſe were. For the profeſſed *Atheiſts* durſt never venture to affirm, that this regular *Syſteme* of things reſulted from the *fortuitous motions* of Atoms at the very firſt, before they had for a long time together produced many other *inept Combinations*, or *aggregate Forms* of particular things and *nonſenſical Syſtems* of the whole, and they ſuppoſed alſo that the *regularity* of things here in this world would not always continue ſuch neither, but that ſome time or other Confuſion and Diſor-

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der will break in again. Moreover that besides this World of ours, there are at this very instant innumerable other Worlds *irregular*, and that there is but one of a thousand or Ten Thousand among the infinite Worlds that have such regularity in them, the reason of all which is, because it was generally taken for granted, and lookt upon as a common notion, that τ' ἀπὸ τύχης & τῶ αὐτομάτῳ ἐδὲν ἀεὶ ὅπω γίνεται, as *Aristotle* expresseth it; none of those things which are from Fortune or Chance come to pass always alike. But our *mechanick Theists* will have their Atoms never so much as once to have fumbled in these their motions, nor to have produced any inept System, or incongruous forms at all, but from the very first all along to have taken up their places and ranged themselves so orderly, methodically and directly; as that they could not possibly have done it better, had they been directed by the most perfect Wisdom. Wherefore these *Atomick Theists* utterly evacuate that grand Argument for a God taken from the *Phænomenon* of the Artificial frame of things, which hath been so much insisted upon in all Ages, and which commonly makes the strongest impression of any other upon the minds of Men &c. the *Atheists* in the mean time laughing in their Sleeves,

Sleeves, and not a little triumphing to ſee the Cauſe of *Theiſm* thus betrayed by its profeſſed Friends and Aſſertors, and the grand Argument for the ſame totally ſlurred by them and ſo their work done, as it were, to their hands.

Now as this argues the greateſt Inſenſibility of mind, or Sottiſhneſs and Stupidity in pretended *Theiſts* not to take the leaſt notice of the regular and artificial frame of things, or of the ſignatures of the Divine Art and Wiſdom in them, nor to look upon the World and things of Nature with any other Eyes than Oxen and Horſes do. So are there many *Phænomena* in Nature, which being partly above the force of theſe *Mechanick Powers*, and partly contrary to the ſame, can therefore never be ſalved by them, nor without *final Cauſes* and ſome *vital Principle*: As for Example, that of Gravity or the tendency of Bodies downward, the motion of the *Diaphragm* in Reſpiration, the *Syſtole* and *Diaſtole* of the Heart, which is nothing but a Muſcular Conſtriction and Relaxation, and therefore not *mechanical* but *vital*. We might alſo add among many others the interſection of the Plains of the *Equator* and *Ecliptick*, or the Earth's diurnal motion upon an *Axis* not parallel to that of the *Ecliptick*, nor perpendicular to the Plain thereof. For though *Des Cartes* would

would needs imagine this Earth of ours once to have been a Sun, and ſo itſelf the centre of a leſſer *Vortex*, whoſe *Axis* was then directed after this manner, and which therefore ſtill kept the ſame Site or Poſture by reaſon of the ſtriate Particles finding no fit Pores or Traces for their paſſages through it, but only in this direction; yet does he himſelf confeſs, that becauſe theſe two motions of the Earth, the Annual and Diurnal, would be much more conveniently made upon parallel *Axes*, therefore, according to the Laws of Mechaniſm, they ſhould be perpetually brought nearer andnearer together, till at length the *Equator* and *Ecliptick* come to have their *axes* parallel, which as it has not yet come to paſs, ſo neither hath there been for theſe laſt Two Thouſand Years (according to the beſt Obſervations and Judgments of Aſtronomers) any nearer approach made of them one to another. Wherefore the continuation of theſe two motions of the Earth the Annual and Diurnal upon *Axes* not parallel is reſolvable into nothing but a *Final* and *Mental* Cauſe, or the τὸ Βέλτιςον, becauſe it was beſt it ſhould be ſo, the variety of the Seaſons of the year depending thereupon. But the greateſt of all the particular *Phænomena* is the Formation and Organization of the Bodies

dies of Animals, consisting of such variety and curiosity; that these mechanick Philosophers being no way able to give an account thereof from the necessary motion of Matter, *unguided by Mind for Ends*, prudently therefore break off their System there, when they should come to Animals, and so leave it altogether untoucht. We acknowledg indeed there is a *Posthumous* piece extant, imputed to *Cartes*, and entituled, *De la formation du Fœtus*, wherein there is some Pretence made to salve all this by fortuitous Mechanism. But as the Theory thereof is built wholly upon a false supposition, sufficiently confuted by our *Harvey* in his Book of *Generation*, *that the Seed doth materially enter into the composition of the Egg*: So is it all along precarious and exceptionable; nor doth it extend at all to the differences that are in several *Animals*, nor offer the least reason why an *Animal* of one *Species* might not be formed out of the Seed of another. Thus far the *Doctor*, with whom for the main I do consent. I shall only add, that Natural Philosophers, when they endeavor to give an account of any of the Works of Nature by preconceived Principles of their own, are for the most part grosly mistaken and confuted by Experience; as *Des Cartes* in a mat-

matter that lay before him, obvious to ſenſe and infinitly more eaſie to find out the Cauſe of, than to give an account of the Formation of the World; that is the Pulſe of the Heart, which he attributes to an Ebullition and ſudden expanſion of the Blood in the Ventricles, after the manner of Milk, which being heated to ſuch a Degree doth ſuddenly and as it were all at once fluſh up and run over the Veſſel. Whether this Ebullition be cauſed by a Nitro-Sulphureous ferment lodged eſpecially in the left Ventricle of the Heart, which mingling with the Blood excites ſuch an Ebullition, as we ſee made by the mixture of ſome Chymical Liquors, *viz.* Oil of Vitriol, and deliquated Salt of Tartar; or by the vital flame warming and boyling the Blood. But this conceit of his is contrary both to Reaſon and Experience, For firſt, It is altogether unreaſonable to imagine and affirm that the cool venal Blood ſhould be heated to ſo high a degree in ſo ſhort a time as the interval of two Pulſes, which is leſs than the ſixth part of a Minute. Secondly, In cold Animals, as for Example *Eels*, the Heart will beat for many hours after it is taken out of the Body, yea tho the Ventricle be opened and all the Blood ſqueezed out. Thirdly, The proceſs of the Fibres which com-

compound the ſides of the Ventricles running in Spiral Lines from the Tip to the Baſe of the Heart, ſome one way and ſome the contrary, do clearly ſhew that the *Syſtole* of the Heart is nothing but a Muſcular conſtriction, as a Purſe is ſhut by drawing the Strings contrary ways: Which is alſo confirm'd by Experience; for if the *Vertex* of the Heart be cut off, and a finger thruſt up into one of the Ventricles, in every *Syſtole* the Finger will be ſenſibly and manifeſtly pincht by the ſides of the Ventricle. But for a full Confutation of this Fancy, I refer the Reader to Dr. *Lower*'s Treatiſe *de Corde*, Chap. 2. and his Rules concerning the transferring of Motion from one Body in motion to another are the moſt of them by Experience found to be falſe, as they affirm which have made Trial of them.

This Pulſe of the Heart Dr. *Cudworth* would have to be no Mechanical but a Vital motion, which to me ſeems probable, becauſe it is not under the command of the Will, nor are we conſcious of any Power to cauſe or to reſtrain it, but it is carried on and continued without our knowledge or notice; neither can it be cauſed by the impulſe of any external movent, unleſs it be Heat. But how can the Spirits agitated by Heat, unguided by a *vital Principle* pro-

duce

duce ſuch a regular reciprocal motion? If that Site which the Heart and its Fibres have in the *Diaſtole* be moſt natural to them, (as it ſeems to be) why doth it again contract itſelf, and not reſt in that poſture? If it be once contracted in a *Syſtole* by the influx of the Spirits, why, the Spirits continually flowing in without let, doth it not always remain ſo? [For the *Syſtole* ſeems to reſemble the forcible bending of a Spring, and the *Diaſtole* its flying out again to its natural ſite.] What is the Spring and principal Efficient of this Reciprocation? What directs and moderates the motions of the Spirits? They being but ſtupid and ſenſeleſs matter, cannot of themſelves continue any regular and conſtant motion, without the guidance and regulation of ſome intelligent Being. You will ſay, what Agent is it which you would have to effect this? The ſenſitive Soul it cannot be, becauſe that is indiviſible, but the Heart, when ſeparated wholly from the Body in ſome *Animals*; continues ſtill to pulſe for a conſiderable time; nay when it hath quite ceaſed, it may be brought to beat anew by the Application of warm Spittle, or by pricking it gently with a Pin or Needle. I anſwer, it may be in theſe Inſtances, the ſcattering Spirits remaining

ing in the Heart, may for a time being agitated by heat, cauſe theſe faint Pulſations; though I ſhould rather attribute them to a *plaſtick Nature* or vital Principle, as the Vegetation of Plants muſt alſo be.

But to proceed, neither can I wholly acquieſce in the *Hypotheſis* of that *Honourable and deſervedly famous Author* I formerly had occaſion to mention; which I find in his *free Enquiry into the vulgar Notion of Nature*, P. 77, 78. delivered in theſe Words, "I think it probable, that the great and "wiſe Author of things did, when he firſt "formed the Univerſal and Undiſtinguiſh-"ed Matter into the World, put its parts "into various Motions, whereby they were "neceſſarily divided into numberleſs Porti-"ons of differing Bulks, Figures and Situ-"ations in reſpect of each other. And that "by his infinite Wiſdom and Power he did "ſo guide and over-rule the motions of theſe "Parts, at the beginning of things, as that "(whether in a ſhorter or a longer time "Reaſon cannot determine) they were fi-"nally diſpoſed into that Beautiful and Or-"derly Frame that we call the *World*; a-"mong whoſe Parts ſome were ſo curiouſ-"ly contrived, as to be fit to become the "Seeds or ſeminal Principles of Plants and "Animals. And I further conceive, that

"he

" he ſetled ſuch Laws or Rules of local Moti-
" on, among the parts of the Univerſal Matter,
" that by his ordinary and preſerving Con-
" curſe the ſeveral parts of the Univerſe thus
" once completed, ſhould be able to maintain
" the great Conſtruction or Syſtem and Oeco-
" nomy of the mundane Bodies, and propagate
" the Species of living Creatures. The ſame *Hypotheſis* he repeats again, Pag. 124, 125. of the ſame Treatiſe.

This *Hypotheſis*, I ſay, I cannot fully acquieſce in, becauſe an intelligent Being ſeems to me requiſite to execute the Laws of Motion. For firſt Motion being a fluent thing, and one part of its Duration being abſolutely independent upon another: it doth not follow that becauſe any thing moves this moment, it muſt neceſſarily continue to do ſo the next; but it ſtands in as much need of an Efficient to preſerve and continue its motion as it did at firſt to produce it. Secondly, Let Matter be divided into the ſubtileſt parts imaginable, and theſe be moved as ſwiftly as you will; it is but a ſenſleſs and ſtupid Being ſtill, and makes no nearer approach to Senſe, Perception, or vital Energy than it had before; and do but only ſtop the internal motion of its parts and reduce them to Reſt, the fineſt and moſt ſubtile Body that is may be-

come as groſs, and heavy, and ſtiff as Steel or Stone. And as for any external Laws or eſtabliſhed Rules of Motion, the ſtupid Matter is not capable of obſerving or taking any notice of them; neither can thoſe Laws execute themſelves: Therefore there muſt beſides Matter and Law be ſome Efficient; and that either a Quality or Power inherent in the Matter itſelf, which is hard to conceive, or ſome external intelligent Agent, either God himſelf immediately, or ſome *Plaſtick Nature.* This latter I incline to, for the Reaſons alledged by Dr. *Cudworth* in his Syſtem, Pag. 149. which are; Firſt, Becauſe the former, according to vulgar apprehenſion, would render the Divine Providence operoſe, ſolicitous and diſtractious: and thereby make the belief of it entertained with greater difficulty, and give advantage to Atheiſts. Secondly, It is not ſo decorous in reſpect of God, that he ſhould ἀυτουργεῖν ἅπαντα, ſet his own hand as it were to every work, and immediately do all the meaneſt and triflingſt things himſelf drudgingly, without making uſe of any inferiour or ſubordinate Miniſters. Theſe two Reaſons are plauſible, but not cogent, the two following are of greater force. Thirdly, The ſlow and gradual Proceſs that is in the generation of things, which would ſeem to be a vain and idle Pomp or trifling Formality

lity, if the Agent were omnipotent. Fourthly, Thoſe ἁμαρτήματα, as *Ariſtotle* calls them, thoſe Errors and Bungles which are committed when the matter is inept or contumacious, as in Monſters, &c. which argue the Agent not to be irreſiſtible; and that Nature is ſuch a thing as is not altogether uncapable, as well as Human Art, of being ſometimes fruſtrated and diſappointed by the indiſpoſition of the Matter: Whereas an Omnipotent Agent would always do its Work infallibly and irreſiſtibly, no ineptitude or ſtubbornneſs of the Matter being ever able to hinder ſuch an one, or make him bungle or fumble in any thing. So far the Doctor. For my part, I ſhould make no Scruple to attribute the formation of *Plants*, their growth and nutrition to the vegetative Soul in them; and likewiſe the formation of *Animals* to the vegetative Power of their Souls; but that the Segments and Cuttings of ſome Plants, nay the very Chips and ſmalleſt Fragments of their Body, Branches, or Roots, will grow and become perfect Plants themſelves, and ſo the vegetative Soul, if that were the Architect, would be diviſible, and conſequently no ſpiritual or intelligent Being; which the *Plaſtick Principle* muſt be, as we have ſhewn. For that muſt preſide over the whole Oeconomy of the

Plant, and be one ſingle Agent, which takes care of the Bulk and Figure of the whole, and the Situation, Figure, Texture of all the Parts, Root, Stalk, Branches, Leaves, Flowers, Fruit, and all their Veſſels and Juices. I therefore incline to Dr. *Cudworth*'s Opinion, that God uſes for theſe Effects the ſubordinate Miniſtry of ſome inferiour *Plaſtick Nature*; as in his works of Providence he doth of Angels. For the Deſcription whereof I refer the Reader to his *Syſtem*.

Secondly, In particular I am difficult to believe, that the *Bodies* of *Animals* can be formed by Matter divided and moved by what Laws you will or can imagine, without the immediate Preſidency, Direction and Regulation of ſome Intelligent Being. In the generation or firſt formation of, ſuppoſe the Human Body, out of (though not an Homogeneous Liquor, yet) a fluid Subſtance, the only material Agent or Mover is a moderate Heat. Now how this, by producing an inteſtine Motion in the particles of the Matter, which can be conceived to differ in nothing elſe but Figure, Magnitude and Gravity, ſhould by virtue thereof, not only ſeparate the Heterogeneous Parts, but aſſemble the Homogeneous into Maſſes or Syſtems, and that not each kind into one Maſs, but into many and disjoyned ones, as it were ſo many Troups;

Troups; and that in each Troup the particular Particles ſhould take their places, and caſt themſelves into ſuch a figure; as for Example, the Bones being about 300 are formed of various ſizes and ſhapes, ſo ſituate and connected, as to be ſubſervient to many hundred Intentions and Uſes, and many of them conſpire to one and the ſame Action, this, I ſay, I cannot by any means conceive. I might inſtance in all the Homogeneous Parts of the body, their Sites and Figures; and ask by what imaginable laws of Motion their bulk, figure, ſituation and connexion can be made out? What account can be given of the Valves, of the Veins and Arteries of the heart, and of the Veins elſewhere, and of their ſituation; of the figure and conſiſtency of all the Humours and Membranes of the eye, all conſpiring and exactly fitted to the uſe of Seeing; but I have touched upon that already, and ſhall diſcourſe of it largely afterward. You will ask me who or what is the Operator in the Formation of the bodies of Man and other Animals? I anſwer, The ſenſitive Soul itſelf, if it be a ſpiritual and immaterial Subſtance, as I am inclineable to believe: But if it be material, and conſequently the whole *Animal* but a mere Machine or *Automaton*, as I can hardly admit, then muſt we have recourſe to a *Plaſtick Nature*.

That the Soul of Brutes is material, and the whole Animal, Soul and Body, but a mere Machine is the Opinion publickly owned and declared, of *Des Cartes*, *Gassendus*, Dr. *Willis* and others; the same is also necessarily consequent upon the Doctrine of the Peripateticks, *viz.* that the sensitive Soul is educed out of the Power of the Matter. For nothing can be educed out of the matter, but what was there before, which must be either Matter or some Modification of it. And therefore they cannot grant it to be a spiritual Substance, unless they will assert it to be educed out of nothing. This Opinion, I say, I can hardly digest. I should rather think Animals to be endued with a lower Degree of Reason, than that they are mere Machines. I could instance in many Actions of *Brutes* that are hardly to be accounted for without Reason and Argumentation; as that commonly noted of Dogs, that running before their Masters they will stop at a divarication of the way, till they see which hand their Masters will take; and that when they have gotten a Prey, which they fear their Masters will take from them, they will run away and hide it, and afterwards return to it; and many the like Actions, which I shall not spend time to relate. Should this be true, that Beasts were *Automata* or Machines

chines, they could have no ſenſe or perception of Pleaſure or Pain, and conſequently no Cruelty could be exerciſed towards them; which is contrary to the doleful ſignifications they make when beaten or tormented, and contrary to the common ſence of Mankind, all men naturally pitying them as apprehending them to have ſuch a ſenſe and feeling of Pain and Miſery as themſelves have; whereas no man is troubled to ſee a Plant torn, or cut, or ſtampt, or mangled how you pleaſe. Beſides, having the ſame Members and Organs of Senſe as we have, it is very probable they have the ſame Senſations and Perceptions with us. To this *Des Cartes* anſwers or indeed ſaith, he hath nothing to anſwer; but that if they think as well as we, they have an immortal Soul as well as we: Which is not at all likely, becauſe there is no reaſon to believe it of ſome Animals without believing it of all, whereas there are many too too imperfect to believe it of them, ſuch as are *Oyſters* and *Sponges* and the like. To which I anſwer that there is no Neceſſity they ſhould be immortal, becauſe it is poſſible they may be deſtroyed or annihilated. But I ſhall not wade further into this Controverſie, becauſe it is beſide my Scope, and there hath been as much written of it already as I have to ſay,

by Dr. *More*, Dr. *Cudworth*, *Des Cartes*, Dr. *Willis* and others, *Pro* and *Con.*

Of the viſible Works of God *and their Diviſion.*

I come now to take a view of the Works of the Creation, and to obſerve ſomething of the Wiſdom of God diſcernable in the Formation of them, in their Order and Harmony, and in their Ends and Uſes. And firſt I ſhall run them over ſlightly, remarking chiefly what is obvious and expoſed to the Eyes and notice of the more careleſs and incurious Obſerver. Secondly, I ſhall ſelect one or two particular Pieces, and take a more exact ſurvey of them; though even in theſe more will eſcape our notice than can be diſcovered by the moſt diligent Scrutiny: For our Eyes and Senſes, however armed or aſſiſted, are too groſs to diſcern the curioſity of the Workmanſhip of Nature, or thoſe minute Parts by which it acts, and of which Bodies are compoſed; and our Underſtanding too dark and infirm to diſcover and comprehend all the Ends and Uſes to which the infinitely wiſe Creator did deſign them.

But before I proceed, being put in mind thereof by the mention of the aſſiſtance of our Eyes, I cannot omit one general Obſervation concerning the curioſity of the Works

of

of Nature in comparison of the Works of Art, which I shall propose in the late *Bishop of* Chesters *Words*. "The Observations "which have been made in these latter times "by the help of the *Microscrope*, since we "had the use and improvement of it, dis- "cover a vast difference between Natural "and Artificial Things. Whatever is natu- "ral beheld through that appears exquisite- "ly formed, and adorned with all ima- "ginable Elegancy and Beauty. There are "such inimitable gildings in the smallest Seeds "of Plants, but especially in the parts of A- "nimals, in the Head or Eye of a small Fly; "such Accuracy, Order, and Symmetry in the "frame of the most minute Creatures, a "*Louse*, for Example, or a *Mite*, as no Man "were able to conceive without seeing of "them. Whereas the most curious Works "of Art, the sharpest and finest Needle doth "appear as a blunt rough Bar of Iron, com- "ing from the Furnace or the Forge: the "most accurate engravings or embossments "seem such rude, bungling and deformed "Work, as if they had been done with a "Mattock or a Trowel, so vast a difference is "there betwixt the Skill of Nature, and "the Rudeness and Imperfection of Art. I "might add, that the Works of Nature the "better Lights and Glasses you use, the "more

Treat. of Nat. Religion. Lib. 1. c. 6.

" more cleaver and exactly formed they ap-
" pear; whereas the effects of human Art the
" more curiouſly they are viewed and exami-
" ned, the more of Deformity they diſcover.

This being premiſed; for our more clear and diſtinct proceeding in our curſory View of the Creation, I ſhall rank the parts of this material and viſible World under ſeveral Heads. Bodies are either *inanimate* or *animate*. *Inanimate* Bodies are either *celeſtial* or *terreſtrial*. *Celeſtial* as the *Sun, Moon and Stars: Terreſtrial* are either *ſimple* as the four Elements, *Fire, Water, Earth and Air*; or *mixt*, either *imperfectly* as the *Meteors*, or more *perfectly*, as *Stones, Metals, Minerals* and the like. *Animate* Bodies are either ſuch as are endued with a *Vegetative* Soul, as *Plants*; or a *Senſitive* Soul, as the Bodies of *Animals, Birds, Beaſts, Fiſhes and Inſects*; or a *Rational* Soul, as the Body of *Man* and the Vehicles of *Angels*, if any ſuch there be.

I make uſe of this Diviſion to comply with the common and received Opinion, and for eaſier Comprehenſion and Memory; though I do not think it agreeable to Philoſophick Verity and Accuracy; but do rather incline to the *Atomick Hypotheſis*. For theſe Bodies we call *Elements* are not the only ingredients of mixt Bodies; neither

are

are they abſolutely ſimple themſelves, as they do exiſt in the World, the Sea-water containing a copious Salt manifeſt to Senſe; and both Sea and Freſh-water ſufficing to nouriſh many Species of Fiſh, and conſequently containing the various parts of which their Bodies are compounded. And I believe there are many Species of Bodies which the *Peripateticks* call Mixt, which are as ſimple as the *Elements* themſelves, as *Metals*, *Salts*, and ſome ſorts of *Stones*. I ſhould therefore with Dr. *Grew* and others, rather attribute the various Species of inanimate Bodies to the divers figures of the minute Particles of which they are made up: And the reaſon why there is a ſet and conſtant number of them in the World, none deſtroyed, nor any new ones produced, I take to be, becauſe the ſum of the figures of thoſe minute Bodies into which matter was at firſt divided, is determinate and fixt. 2. Becauſe thoſe minute parts are indiviſible, not abſolutely, but by any natural force; ſo that there neither is nor can be more or fewer of them: For were they diviſible into ſmall and diverſly figured parts by Fire or any other natural Agent, the Species of Nature muſt be confounded, ſome might be loſt and deſtroyed, but new ones would certainly be produced; unleſs we could ſuppoſe,

poſe, theſe new diminutive Particles ſhould again aſſemble and marſhal themſelves into corpuſcles of ſuch figures as they compounded before; which I ſee no poſſibility for them to do, without ſome θεὸς ἀπὸ μηχανῆς to direct them: Not that I think theſe inanimate Bodies to conſiſt wholly of one ſort of *Atoms*, but that their Bulk conſiſts mainly or chiefly of one ſort. But whereas it may be objected that Metals, (which of all others ſeem to be moſt ſimple) may be tranſmuted one into another, and ſo the *Species* doth not depend upon the being compounded of *Atoms* of one figure. I anſwer, I am not fully ſatisfied of the matter of Fact: But if any ſuch Tranſmutation be, poſſibly all Metals may be of one Species, and the diverſity may proceed from the admixture of different Bodies with the principles of the Metal. If it be asked, why may not Atoms of different Species concur to the compoſition of Bodies? and ſo though there be but a few ſorts of original Principles may there not be produced infinite Species of compound Bodies, as by the various diſpoſitions and combinations of Twenty Four Letters innumerable Words may be made up? I anſwer becauſe the Heterogeneous Atoms or Principles are not naturally apt to cohere and ſtick together when

when they are mingled in the ſame Liquor, as the Homogeneous readily do.

I do not believe that the *Species* of Principles or indiviſible Particles are exceeding numerous: But poſſibly the immediate component Particles of the Bodies of Plants and Animals may be themſelves compounded.

Of the Heavenly Bodies.

Firſt, For the Celeſtial or Heavenly Bodies, the Equability and Conſtancy of their Motions, the certainty of their Periods and Revolutions, the conveniency of their Order and Situations argue them to be ordained and governed by Wiſdom and Underſtanding; yea ſo much Wiſdom as Man cannot eaſily fathom or comprehend. For we ſee by how much the *Hypotheſes* of Aſtronomers are more ſimple and conformable to Reaſon, by ſo much do they give a better account of the Heavenly Motions. It is reported of *Alphonſus* King of *Aragon*, I know not whether truly, that when he ſaw and conſidered the many *Eccentricks*, *Epicycles*, *Epicycles* upon *Epicycles*, *Librations*, and contrariety of Motions, which were requiſite in the old *Hypotheſis* to give an account of the *Celeſtial Phænomena*, he ſhould preſume blaſphemouſly to ſay, that the Univerſe was

a bungling Piece; and that if he had been of God's Counſel, he could have directed him to have made it better. A Speech as raſh and ignorant, as daring and prophane.

For it was nothing but Ignorance of the true proceſs of Nature that induced the Contrivers of that *Hypotheſis* to invent ſuch abſurd Suppoſitions, and him to accept them for true, and attribute them to the great Author of the Heavenly Motions. For in the New *Hypotheſis* of the modern Aſtronomers, we ſee moſt of thoſe Abſurdities and Irregularities rectified and removed, and I doubt not but they would all vaniſh, could we certainly diſcover the true Method and Proceſs of Nature in thoſe Revolutions. For ſeeing in thoſe Works of Nature which we converſe with, we conſtantly find thoſe Axioms true, *Natura non facit circuitus*, Nature doth not fetch a Compaſs when it may proceed in a ſtreight Line; and *Natura nec abundat in ſuperfluis, nec deficit in neceſſariis*, Nature abounds not in what is ſuperfluous, neither is deficient in what is neceſſary: We may alſo rationally conclude concerning the Heavenly Bodies, ſeeing there is ſo much Exactneſs obſerved in the time of their Motions, that they punctually come about in the ſame Periods to the hundredth part of a Minute, as may beyond Exception be demonſtrated

monſtrated by comparing their Revolutions, ſurely there is alſo uſed the moſt ſimple, facile, and convenient way for the performance of them. Among theſe Heavenly Bodies;

Firſt, The *Sun*, a vaſt Globe of Fire, eſteemed by the ancienter and moſt modeſt Computation above 160 times bigger than the Earth, the very life of this inferiour World, without whoſe ſalutary and vivifick Beams all Motion both Animal, Vital and Natural would ſpeedily ceaſe, and nothing be left here below but Darkneſs and Death: All Plants and Animals muſt needs in a very ſhort time be not only mortified, but together with the ſurface of Land and Water frozen as hard as Flint or Adamant: So that of all the Creatures of the World the ancient Heathen had moſt reaſon to worſhip him as a God, though no true reaſon; becauſe he was but a Creature, and not God: And we Chriſtians to think that the Service of the Animals that live upon the Earth, and principally Man, was one end of his Creation; ſeeing without him there could no ſuch things have been. This *Sun*, I ſay, according to the old *Hypotheſis* whirled round about the Earth daily with incredible celerity, making Night and Day by his riſing and ſetting; Winter and Summer by his acceſs to the ſeveral Tropicks, creating ſuch a

grateful

grateful variety of Seaſons, enlightening all parts of the Earth by his Beams, and cheriſhing them by his Heat, ſituate and moved ſo in reſpect of this ſublunary World, (and it's likely alſo in reſpect of all the Planets about him) that Art and Counſel could not have deſigned either to have placed him better, or moved him more conveniently for the ſervice thereof; as I could eaſily make appear by the Inconveniences that would follow upon the Suppoſition of any other ſituation and motion, ſhews forth the great Wiſdom of him who ſo diſpoſed and moved him.

Secondly, The *Moon*, a Body in all probability ſomewhat like the Earth we live upon, by its conſtant and regular Motion helps us to divide our time, reflects the Sun beams to us, and ſo by illuminating the Air, takes away in ſome meaſure the diſconſolate darkneſs of our Winter Nights, procures or at leaſt regulates the Fluxes and Refluxes of the Sea, whereby the Water is kept in conſtant Motion, and preſerved from Putrefaction, and ſo rendred more ſalutary for the maintenance of its Breed, and uſeful and ſerviceable for Man's conveniencies of Fiſhing and Navigation; not to mention the great Influence it is ſuppoſed to have upon all moiſt Bodies, and the growth and increaſe of Vegetables and Animals: Men generally obſerving

obſerving the Age of the Moon in the planting of all kind of Trees, ſowing of Grain, grafting and inoculating, and pruning of Fruit-Trees, gathering of Fruit, cutting of Corn or Graſs; and thence alſo making Prognoſticks of Weather, becauſe ſuch Obſervations ſeem to me uncertain. Did this *Luminary* ſerve to no other ends and uſes, as I am perſwaded it doth many, eſpecially to maintain the Creatures which in all likelihood breed and inhabit there, yet theſe were enough to evince it to be the Effect and Product of Divine Wiſdom and Power.

Thirdly, As for the reſt of the *Planets*; beſides their particular Uſes, which are to us unknown, or merely conjectural, their Courſes and Revolutions, their Stations and Retrogradations, obſerved conſtantly ſo many Ages together in moſt certain and determinate Periods of time, do ſufficiently demonſtrate that their Motions are inſtituted and governed by Counſel, Wiſdom and Underſtanding.

Fourthly, The like may be ſaid of the *fixt Stars* whoſe Motions are regular, equal and conſtant. So that we ſee nothing in the Heavens which argues Chance, Vanity, or Error; but on the contrary, Rule, Order and Conſtancy; the Effects and Arguments of Wiſdom: Wherefore as *Cicero* excellently

concludes, *Cœleſtem ergo admirabilem ordinem, incredibilemque conſtantiam, ex qua conſervatio & ſalus omnium omnis oritur, qui vacare mente putat, næ ipſe mentis expers habendus eſt.*: Wherefore whoſoever thinketh that the admirable Order and incredible Conſtancy of the Heavenly Bodies and their Motions, whereupon the Preſervation and Welfare of all things doth depend, is not governed by Mind and Underſtanding, he himſelf is to be accounted void thereof. And again, Shall we (ſaith he) when we ſee an artificial Engine, as a Sphere, or Dial, or the like, at firſt ſight acknowledg, that it is a work of Reaſon and Art: *Cùm autem impetum cæli, admirabili cum celeritate moveri vertique videamus, conſtantiſſimè conficientem viciſſitudines anniverſarias, cum ſummâ Salute & Conſervatione rerum omnium, dubitare quin ea non ſolùm ratione fiant, ſed excellenti quâdam Divinâque ratione*: And can we when we ſee the force of the Heavens moved and whirled about with admirable Celerity, moſt conſtantly finiſhing its anniverſary Viciſſitudes, to the eminent Welfare and Preſervation of all things, doubt at all that theſe things are performed not only by Reaſon, but by a certain excellent and Divine Reaſon.

To theſe things I ſhall add an Obſervation, which I muſt confeſs my ſelf to have borrowed

borrowed of the honourable Perſon more than once mentioned already, that even the *Eclipſes* of the *Sun* and *Moon*, though they be frightful things to the ſuperſtitious Vulgar, and of ill influence on Mankind, if we may believe the no leſs ſuperſtitious Aſtrologers, yet to knowing men, that can skilfully apply them, they are of great Uſe, and ſuch as common Heads could never have imagined: Since not only they may on divers Occaſions help to ſettle *Chronology*, and rectifie the Miſtakes of *Hiſtorians* that writ many Ages ago; but which is, though a leſs Wonder, yet of greater Utility, they are (as things yet ſtand) neceſſary to define with competent Certainty, the Longitude of places or points on the Terraqueous Globe, which is a thing of very great moment not only to *Geography*, but to the moſt uſeful and important Art of *Navigation*. To which may be added, which I ſhall hereafter mention, that they ſerve to demonſtrate the ſpherical roundneſs of the Earth. So that I may well conclude with the Pſalmiſt, Pſalm 19. 1. *The Heavens declare the Glory of God, and the Firmament ſheweth his handy Work.*

Of Terreſtrial inanimate ſimple Bodies.

I come now to conſider the Terreſtrial Bodies; I ſhall ſay nothing of the whole Body of the Earth in general, becauſe I reſerve that as one of the Particulars I ſhall more carefully and curiouſly examine.

Terreſtrial Bodies according to our Method before propounded are either *inanimate* or *animate*, and the *inanimate* either *ſimple* or *mixt*: *Simple*, as the four *Elements*, *Fire*, *Water*, *Earth*, and *Air*; I call theſe *Elements* in compliance (as I ſaid before) with the vulgarly received Opinion; not that I think them to be the Principles or component Ingredients of all other ſublunary Bodies: I might call them the four great Aggregates of Bodies of the ſame Species, or four ſorts of Bodies of which there are great Aggregates. Theſe notwithſtanding they are endued with contrary Qualities, and are continually encroaching one upon another, yet they are ſo balanced and kept in ſuch an *æquilibrium*, that neither prevaileth over other, but what one gets in one place it loſeth in another.

Firſt, *Fire* cheriſheth and reviveth by its Heat, without which all things would be torpid and without Motion, nay without Fire no Life;

Life; it being the vital Flame reſiding in the Blood that keeps the bodily Machine in motion, and renders it a fit Organ for the Soul to work by. The Uſes of Fire (I do not here ſpeak of the Peripateticks Elementary Fire in the concave of the Moon, which is but a mere Figment, but our ordinary Culinary) are in a manner infinite for dreſſing and preparing of Victuals baked, boyled and roaſt; for melting and refining of Metals and Minerals; for the fuſion of Glaſs, a Material whoſe Uſes are ſo many that it is not eaſie to enumerate them, it ſerving us to make Windows for our Houſes, drinking Veſſels, Veſſels to contain and preſerve all ſorts of fermented Liquors, deſtilled Waters, Spirits, Oils, Extracts, and other Chymical Preparations, as alſo Veſſels to deſtil and prepare them in; for Looking Glaſſes, Spectacles, Microſcopes and Teleſcopes, whereby our Sight is not only relieved, but wonderfully aſſiſted to make rare Diſcoveries: For making all ſorts of Inſtruments for Huſbandry, mechanick Arts and Trades, all ſorts of Arms or Weapons of War defenſive and offenſive; for fulminating Engines; for burning of Lime, baking of Bricks, Tiles, and all ſorts of Potters Veſſels or earthen Ware; for caſting and forging metalline Veſſels and Utenſils; for Deſtillations, and all Chymical

Operations hinted before in the use of Glass. For affording us Light for any Work or Exercise in winter Nights; for digging in Mines and dark Caverns: And finally by its comfortable Warmth securing us from the injuries of Cold, or relieving when we have been bitten and benummed with it. A Subject or Utensil of so various and inexplicable use, who could have invented and formed, but an infinitely wise and powerful Efficient?

Secondly, The *Air* serves us and all Animals to breath in, containing the fewel of that vital Flame we spake of, without which it would speedily languish and go out. So necessary is it for us and other Land-Animals, that without the use of it we could live but very few minutes: Nay Fishes and other Water-Animals cannot abide without the use of it: For if you put Fish into a Vessel of a narrow mouth full of Water, they will live and swim there not only days and months but even years. But if with your Hand or any other cover you stop the Vessel so as wholly to exclude the Air, or interrupt its communication with the Water, they will suddenly be suffocated; as *Rondeletius* affirms he often experimented: If you fill not the Vessel up to the top, but leave some space empty for the Air

to

to take up, and then clap your hand upon the mouth of the Veſſel; the Fiſhes will preſently contend which ſhall get uppermoſt in the Water, that ſo they may enjoy the open Air; which I have alſo obſerved them to do in a Pool of Water that hath been almoſt dry in the Summer-time becauſe the Air that inſinuated itſelf into the Water did not ſuffice them for Reſpiration. Neither is it leſs neceſſary for Inſects than it is for other Animals but rather more, theſe having more Air-veſſels for their Bulk by far than they, there being many Orifices on each ſide their Bodies for the admiſſion of Air, which if you ſtop with Oil or Hony, the Inſect preſently dies, and revives no more. This was an Obſervation of the Ancients, though the reaſon of it they did not underſtand (*Oleo illito Inſecta omnia exanimantur.* Plin.) which was nothing but the intercluding of the Air; for though you put Oil upon them, if you put it not upon or obſtruct thoſe Orifices therewith whereby they draw the Air, they ſuffer nothing: If you obſtruct only ſome and not others, the parts which are near and ſupplied with Air from thence are by and by convulſed and ſhortly relaxed and deprived of Motion, the reſt that were untoucht ſtill retaining it. Nay more than all this, Plants

themſelves have a kind of reſpiration, being furniſhed with plenty of Veſſels for the derivation of Air to all their parts, as hath been obſerved, nay firſt diſcovered by that great and curious Naturaliſt *Malpighius*. Another uſe of the Air is to ſuſtain the flight of Birds and Inſects. Moreover by its gravity it raiſes the Water in Pumps, Siphons and other Engines, and performs all thoſe feats which former Philoſophers through Ignorance of the Efficient Cauſe attributed to a Final, namely Natures abhorrence of a Vacuity or empty ſpace. The Elaſtick or expanſive faculty of the Air, whereby it dilates itſelf, when compreſſed (indeed this lower Region of it by reaſon of the weight of the ſuperincumbent is always in a compreſſed State) hath been made uſe of in the common Weather-glaſſes, in Wind guns, and in ſeveral ingenious Water-works, and doubtleſs hath a great Intereſt in many natural Effects and Operations.

Againſt what we have ſaid of the neceſſity of the Air for the maintenance of the Vital Flame, it may be objected, That the *Fœtus* in the Womb Lives; its Heart Pulſes; and its Blood Circulates; and yet it draws in no Air, neither hath the Air any Acceſs to it. To which I Anſwer, That it doth receive Air ſo much as is ſufficient

ficient for it in its preſent ſtate from the maternal Blood by the *Placenta uterina*, or the *Cotyledones*. This Opinion generally propounded, *viz.* That the Reſpiration of the Dam, did ſerve the *Fœtus* alſo; or ſupply ſufficient Air to it, I have met with in Books, but the explicit Notion of it I owe to my Learned and worthy Friend Dr. *Edward Hulſe*, which comparing with mine own Anatomical Obſervations, I found ſo conſonant to Reaſon, and highly probable, that I could not but yield a firm Aſſent to it. I ſay then, That the chief Uſe of the Circulation of the Blood through the *Cotyledones* of a Calf in the Womb, (which I have often diſſected) and by Analogy through the *Placenta uterina* in an Humane *Fœtus*, ſeems to be the Impregnation of the Blood with Air; for the feeding of the *vital Flame*. For if it were only for Nutrition, what need of two ſuch great Arteries to convey the Blood thither? It would (one might rationally think) be more likely, that as in the *Abdomen* of every Animal, ſo here there ſhould have been ſome lacteal Veins formed, beginning from the *Placenta*, or *Cotyledons*, which concurring in one common *ductus*, ſhould at laſt empty themſelves into the *vena cava*. Secondly, I have obſerved in a Calf, the umbilical Veſſels to terminate in cer-

certain Bodies divided into a multitude of carneous *papillæ*, as I may ſo call them, which are received into ſo many Sockets of the *Cotyledons* growing on the Womb; which carneous *papillæ* may without force or laceration be drawn out of thoſe Sockets. Now theſe *papillæ* do well reſemble the *Ariſtæ* or *radii* of a Fiſhes Gills, and very probably have the ſame uſe to take in the Air. So that the maternal Blood which flows to the *Cotyledons*, and encircles theſe *papillæ*, communicates by them to the Blood of the *Fœtus*, the Air wherewith it ſelf is impregnate; as the Water flowing about the carneous *radii* of the Fiſhes Gills doth the Air that is lodged therein to them. Thirdly, That the maternal Blood flows moſt copiouſly to the *Placenta uterina* in Women, is manifeſt from the great Hemorrhagy that ſucceeds the ſeparation thereof at the Birth. Fourthly, After the Stomach and Inteſtines are formed, the *fœtus* ſeems to take in its whole nouriſhment by the Mouth; there being always found in the Stomach of a Calf, plenty of the liquor contained in the *Amnios* wherein he ſwims, and *fæces* in his inteſtines, and abundance of urine in the *Allantoides*. So that the *fœtus* in the Womb doth live as it were the life of a Fiſh. Laſtly, Why elſe ſhould there

be

be ſuch an inſtant neceſſity of Reſpiration ſo ſoon as ever the *fœtus* is fallen off from the Womb?

This way we may give a facile and very probable account of it, to wit, becauſe receiving no more Communications of Air from its Dam or Mother, it muſt needs have a ſpeedy ſupply from without, or elſe extinguiſh and die for want of it: Being not able to live longer without Air at its firſt Birth, than it can do afterward.

And here methinks appears a neceſſity of bringing in the agency of ſome Superintendent intelligent Being, be it a *Plaſtick Nature*, or what you will. For what elſe ſhould put the Diaphragm, and all the Muſcles ſerving to Reſpiration in motion all of a ſudden ſo ſoon as ever the *fœtus* is brought forth? Why could they not have reſted as well as they did in the Womb? What aileth them that they muſt needs beſtir themſelves to get in Air to maintain the Creatures life? Why could they not patiently ſuffer it to die? That the Air of it ſelf could not ruſh in is clear; for that on the contrary there is required a great force to remove the incumbent Air, and make room for the external to enter. You will ſay the Spirits do at this time flow to the Organs of Reſpiration; the Diaphragm and

other

other Muſcles which concur to that action, and move them. But what rouſes the Spirits which were quieſcent during the continuance of the *fœtus* in the Womb? Here is no appearing impellent but the external Air, the Body ſuffering no change but of place, out of its cloſe and warm Priſon into the open and cool Air. But how or why that ſhould have ſuch influence upon the Spirits, as to drive them into thoſe Muſcles electively, I am not ſubtil enough to diſcern.

Thirdly, *Water* is one part, and that not the leaſt of our Suſtenance, and that affords the greateſt ſhare of Matter in all Productions; containing in it the Principles or minute component particles of all Bodies. To ſpeak nothing of thoſe inferiour Uſes of Waſhing and Bathing, Dreſſing and preparing of Victuals. But if we ſhall conſider the great *Conceptacula* and Congregations of Water, and the diſtribution of it all over the dry Land in Springs and Rivers; there will occur abundant Arguments of Wiſdom and Underſtanding. The Sea, what infinite variety of Fiſhes doth it nouriſh? *Pſalm* 104.25. in the verſe next to my Text. *The earth is full of thy riches. So is this great aud wide Sea, wherein are things creeping innumerable, both ſmall and great beaſts, &c.* How doth it exactly compoſe itſelf to a le-

vel

vel or equal Superficies, and with the Earth make up one ſpherical Roundneſs? How doth it conſtantly obſerve its Ebbs and Flows, its Spring and Nepe-tides, and ſtill retain its ſaltneſs ſo convenient for the maintenance of its Inhabitants? ſerving alſo the uſes of Man for Navigation, and the convenience of Carriage. That it ſhould be defined by Shores and Strands and Limits, I mean at firſt, when it was natural to it to overflow and ſtand above the Earth. All theſe particulars declare abundance of Wiſdom in their primitive Conſtitution. This laſt the Pſalmiſt takes notice of in the *6th*, *7th*, *8th*, and *9th* verſes of this *Pſalm*. Speaking of the Earth at the firſt Creation, he ſaith, *Thou coveredſt it with the Deep as with a garment, the waters ſtood above the mountains. At thy rebuke they fled, at the voice of thy thunder they haſted away.* (*The mountains aſcend, the valleys deſcend*) *unto the place thou haſt prepared for them. Thou haſt ſet a bound that they may not paſs over: That they turn not again to cover the earth.* Again, the great uſe and convenience, the beauty and variety of ſo many Springs and Fountains, ſo many Brooks and Rivers, ſo many Lakes and ſtanding Pools of Water, and theſe ſo ſcattered and diſperſed all the Earth over; that no great part of it is deſtitute of them,

with

without which it muſt without a ſupply other ways be deſolate and void of Inhabitants; afford abundant Arguments of Wiſdom and Counſel. That Springs ſhould break forth on the ſides of Mountains moſt remote from the Sea. That there ſhould way be made for Rivers through Straits and Rocks, and ſubterraneous Vaults, ſo that one would think that Nature had cut a way on purpoſe to derive the Water, which elſe would overflow and drown whole Countries. That the water paſſing through the Veins of the Earth, ſhould be rendred freſh and potable, which it cannot be by any percolations we can make, but the ſaline Particles will paſs through a tenfold Filtre. That in ſome places there ſhould ſpring forth metallick and mineral Waters, and hot Baths, and theſe ſo conſtant and permanent for many Ages; ſo convenient for divers medicinal Intentions and Uſes, the Cauſes of which things, or the Means and Methods by which they are performed, have not been as yet certainly diſcovered; how can we reaſonably deny that they are the Products and Effects of profound Counſel and Underſtanding?

Laſtly, The *Earth*, which is the baſis and ſupport of all Animals and Plants, and affords them the hard and ſolid part of their Bodies, yielding us Food and Suſtenance

and

and partly alſo Cloathing. How variouſly is the Surface of it diſtinguiſhed into Hills, and Valleys, and Plains, and high Mountains affording pleaſant Proſpects? how curiouſly cloathed and adorned with the grateful verdure of Herbs and ſtately Trees, either diſperſed and ſcattered ſingly, or as it were aſſembled in Woods and Groves, and all theſe beautified and illuſtrated with elegant Flowers and Fruits, *quorum omnium incredibilis multitudo, inſatiabili varietate diſtinguitur*, as *Tully* ſaith. This alſo ſhews forth to them that conſider it both the Power and Wiſdom of God: So that we may conclude with *Solomon Prov.* 3, 19. *The Lord by Wiſdom hath founded the Earth, by Underſtanding hath he eſtabliſhed the Heavens.*

But now, if we paſs from Simple to Mixt Bodies, we ſhall ſtill find more matter of Admiration and Argument of Wiſdom. Of theſe we ſhall firſt conſider thoſe they call imperfectly Mixt, or *Meteors*.

Of Meteors.

As firſt of all *Rain*, which is nothing elſe but Water by the heat of the Sun divided into very ſmall inviſible Parts, aſcending in the Air, till encountring the Cold, it be by degrees condenſed into Clouds and deſcends

deſcends in Drops; this though it be exhaled from the Salt Sea, yet by this Natural Deſtillation is rendred Freſh and Potable, which our Artificial Deſtillations have hitherto been hardly able to effect; notwithſtanding the eminent uſe it would be of to Navigators, and the rewards promiſed to thoſe that ſhould reſolve that Problem of deſtilling Freſh Water out of Salt. That the Clouds ſhould be ſo carried about by the Winds, as to be almoſt equally diſperſed and diſtributed, no part of the Earth wanting convenient Showers, unleſs when it pleaſeth God for the puniſhment of a Nation to withhold Rain by a ſpecial interpoſition of his Providence; or if any Land wants Rain, they have a ſupply ſome other way, as the Land of *Egypt*, though there ſeldom falls any Rain there, yet hath abundant recompence made it by the annual overflowing of the River. This Diſtribution of the Clouds and Rain is to me (I ſay) a great Argument of Providence and divine Diſpoſition; for elſe I do not ſee but why there might be in ſome Lands continual ſucceſſive Droughts for many Years, till they were quite depopulated; in others as laſting Rains, till they were overflown and drowned; and theſe, if the Clouds moved caſually, often happening; whereas ſince the ancienteſt Records

cords of Hiſtory we do not read or hear of any ſuch droughts or inundations, unleſs perhaps that of *Cyprus*, wherein there fell no Rain there for Thirty Six Years, till the Iſland was almoſt quite deſerted, in the Reign of *Conſtantine*.

Again, if we conſider the manner of the Rains deſcent, deſtilling down gradually and by drops, which is moſt convenient for the watering of the Earth, whereas if it ſhould fall down in a continued Stream like a River, it would gall the Ground, waſh away Plants by the Roots, overthrow Houſes, and greatly incommode, if not ſuffocate Animals; if, I ſay, we conſider theſe things and many more that might be added, we might in this reſpect alſo cry out with the Apoſtle, *O the depth of the Riches both of the Wiſdom and Knowledge of God!*

Secondly, Another Meteor is the *Wind*; which how many Uſes it doth ſerve to is not eaſie to enumerate, but many it doth: *viz.* To ventilate and break the Air, and diſſipate noyſom and contagious Vapors, which otherwiſe ſtagnating might occaſion many Diſeaſes in Animals; and therefore it is an Obſervation concerning our Native Country, *Anglia ventoſa, ſi non ventoſa venenoſa*: To transfer the Clouds from place to place, for the more commodious water-

ing of the Earth. To temper the excesses of the Heat, as they find, who in *Brasil*, *New Spain*, the Neighbouring Islands, and other the like Countries near the Equator reap the Benefit of the Breezes. To fill the Sails of Ships, and carry them on their Voyages to remote Countries; which of what eminent advantage it is to Mankind, for the procuring and continuing of Trade and mutual Commerce between the most distant Nations, the illustrating every corner of the Earth, and the perfecting Geography and natural History, is apparent to every Man. To this may be added the driving about of Windmills for grinding of Corn, making of Oyl, draining of Pools, *&c.* That it should seldom or never be so violent and boisterous, as to overturn Houses; yea whole Cities; to tear up Trees by the Roots, and prostrate Woods; to drive the Sea over the lower Countries; as were it the effect of Chance, or meer natural Causes not moderated by a superiour Power, it would in all likelihood often do. All these things declare the Wisdom and Goodness of Him *who bringeth the Winds out of his Treasures.*

Of

Of Inanimate mixt Bodies.

I proceed now to ſuch inanimate Bodies as are called *Perfectè mixta*, perfectly mixt, improperly enough, they being many of them (for ought I know) as ſimple as thoſe they call Elements. Theſe are *Stones*, *Metals*, *Minerals* and *Salts*,

In *Stones*, which one would think were a neglected *Genus*, what variety? What beauty and elegancy? What conſtancy in their temper and conſiſtency, in their Figures and Colours? I ſhall ſpeak of firſt ſome notable Qualities wherewith ſome of them are endued. Secondly, The remarkable Uſes they are of to us. The Qualities I ſhall inſtance in are firſt *Colour*, which in ſome of them is moſt lively, ſparkling, and beautiful; the *Carbuncle* or *Rubine* ſhining with red, the *Sapphire* with blue, the *Emerauld* with green, the *Topaz* or *Chryſolite* of the Ancients with a yellow or gold colour, the *Amethyſt* as it were tinctured with Wine, the *Opal* varying its colours like changeable Taffaty, as it is diverſly expoſed to the Light. Secondly, *Hardneſs*, wherein ſome Stones exceed all other bodies, and among them the *Adamant* all other Stones, being exalted to that degree thereof, that Art in vain endeavors

to counterfeit it, the factitious Stones of Chymists in imitation being easily detected by any ordinary Lapidist. Thirdly, *Figure*, many of them shoot into regular Figures, as *Crystal* and bastard *Diamonds* into Hexagonal; others into those that are more elegant and compounded, as those formed in imitation of the Shels of testaceous Fishes of all sorts, Sharks Teeth and Vertebres, *&c.* If these be originally Stones, or primary Productions of Nature in imitation of Shels and Fishes Bones, and not the Shels and Bones themselves petrified, as we have sometimes thought. Some have a kind of vegetation and resemblance of Plants, as *Corals*, *Pori* and *Fungites*, which grow upon the Rocks like Shrubs: To which I might add our ordinary *Star-stones* and *Trochites*, which I look upon as a sort of Rock-Plants.

Secondly, For the Uses; some serve for Building and many sorts of Vessels and Utensils; for Pillars and Statues and other carved works in *relieve*, for the Temples, ornament of Palaces, Portico's, Piazzas, Conduits, *&c.* as Freestone and Marble; some to burn into Lime as Chalk and Limestone: Some with the mixture of *Beriglia* or *Kelp* to make Glass, as that the *Venetians* call *Cuogolo*, and common Flints which serve also to strike Fire; some to cover Houses as Slates; some for

for marking as *Morochthus*, and the fore-mentioned Chalk, which is a πολύχρηστον, ſerving moreover for manuring Land, and ſome medicinal Uſes; ſome to make Veſſels of which will endure the fire; as that found in the Country of *Chiavenna* near *Plurs*. To theſe uſeful Stones I might add the *Warming-ſtone*, digged in *Cornwal*, which being once well heated at the fire retains its warmth a great while, and hath been found to give eaſe and relief in ſeveral Pains and Diſeaſes, particularly that of the internal Hæmorrhoids. I might alſo take notice that ſome Stones are endued with an *Electrical* or attractive Virtue. I might ſpend much time in the diſcourſing of the moſt ſtrange and unaccountable Nature and Powers of the Loadſtone, a Subject which hath exerciſed the Wits and Pens of the moſt acute and ingenious Philoſophers; and yet the *Hypotheſes* which they have invented to give an account of its admirable *phæno-mena* ſeem to me lame and unſatisfactory. What can we ſay of the ſubtlety, activity, and penetrancy of its *effluvia*, which no obſtacle can ſtop or repel, but they will make their way through all ſorts of Bodies, firm and fluid, denſe and rare, heavy and light, pellucid and opake: Nay they will paſs through a vacuity or empty ſpace, at leaſt

devoid of Air and any other ſenſible Body. Its attractive power of Iron was known to the Ancients, its verticity and direction to the Poles of the Earth is of later Invention: Which of how infinite advantage it hath been to theſe two or three laſt Ages, the great improvement of Navigation and advancement of Trade and Commerce by rendring the remoteſt Countries eaſily acceſſible, the noble Diſcovery of a vaſt Continent or new World, beſides a multitude of unknown Kingdoms and Iſlands, the reſolving experimentally thoſe ancient Problems of the Spherical roundneſs of the Earth; of the Being of *Antipodes*, of the Habitableneſs of the *Torrid Zone*, and the rendring the whole Terraqueous Globe circumnavigable, do abundantly demonſtrate; whereas formerly they were wont to coaſt it, and creep along the Shores, ſcarce daring to venture out of the Ken of Land, when they did having no other guide but the *Cynoſura* or Pole-ſtar and thoſe near it, and in cloudy weather none at all.

As for *Metals*, they are ſo many ways uſeful to Mankind, and thoſe Uſes ſo well known to all, that it would be loſt labor to ſay any thing of them: Only it is remarkable, that thoſe which are of moſt frequent and neceſſary uſe, as Iron, Braſs and Lead,

Lead, are the moſt common and plentiful: Others that are more rare, may better be ſpared, yet are they thereby qualified to be made the common meaſure and ſtandard of the value of all other Commodities, and ſo to ſerve for Coin or Money, to which uſe they have been employed by all civil Nations in all Ages. Of theſe Gold is remarkable for its admirable Ductility and Ponderoſity, wherein it excels all other bodies hitherto known. I ſhall only add concerning Metals, that they do pertinaciouſly reſiſt all Tranſmutation; and though one would ſometimes think they were turned into a different Subſtance, yet do they but as it were lurk under a *Larva* or Vizzard, and may be reduced again into their natural Form and Complexions, in deſpight of all the tortures of Vulcan or corroſive Waters. *Note, That this was written above Thirty Years ſince, when I thought I had reaſon to diſtruſt what ever had then been reported or written to affirm the Tranſmutation of Metals one into another.*

I ſhall omit the conſideration of other Minerals, and of Salts and Earths, becauſe I have nothing to ſay of their Uſes, but only ſuch as refer to Man, which I cannot affirm to have been the ſole or primary End of the Formation of them. Indeed to ſpeak in gene-

ral of these Terrestrial inanimate Bodies, they having no such organization of parts as the Bodies of Animals, nor any so intricate variety of Texture, but that their production may plausibly be accounted for by an *Hypothesis* of matter divided into minute Particles or Atoms naturally indivisible, of various but a determinate number of Figures, and perhaps also differing in Magnitude, and these moved, and continually kept in motion according to certain established Laws or Rules; we cannot so clearly discover the Uses for which they were Created, but may probably conclude that among other Ends they were made for those for which they serve us and other Animals. It is here to be noted, that according to our *Hypothesis*, the number of the Atomes of each several kind that is of the same Figure and Magnitude is not nearly equal; but there be infinitely more of some *species* than of others, as of those that compound those vast Aggregates of *Air*, *Water*, and *Earth*, more abundantly than of such as make up *Metals* and *Minerals*: The reason whereof may probably be, because those are necessary to the Life and Being of Man and all other Animals, and therefore must be always at hand; these only useful to Man, and serving rather his Conveniences than Necessities. The reason why I affirm the minute

nute component Particles of Bodies to be naturally indiviſible by any Agent we can employ, even Fire it ſelf (which is the only Catholick Diſſolvent, other *menſtruums* being rather Inſtruments than Efficients in all Solutions, apt by reaſon of the figure and ſmalneſs of their Parts to cut and divide other Bodies, (as Wedges cleave Wood) when actuated by fire or its heat, which elſe would have no efficacy at all; as Wedges have not unleſs driven by a Beetle:) the reaſon, I ſay, I have already given; I ſhall now inſtance in a Body whoſe minute Parts appear to be indiſſoluble by the force of Fire, and that is common Water, which deſtill, boil, circulate, work upon how you will by Fire, you can only diſſolve it into Vapour, which when the motion ceaſes eaſily returns into Water again; Vapour being nothing elſe but the minute Parts thereof by heat agitated and ſeparated one from another. For another Inſtance, ſome of the moſt Learned and experienced Chymiſts do affirm Quick-ſilver to be intranſmutable, and therefore call it *Liquor æternus*. And I am of opinion that the ſame holds of all ſimple Bodies, that their component Particles are indiſſoluble, by any natural Agent.

Of

Of Vegetables or Plants.

I have now done with Inanimate Bodies both Simple and Mixt. The Animate are

Firſt, Such as are endued only with a Vegetative Soul, and therefore commonly called *Vegetables* or *Plants*; of which if we conſider either their Stature and Shape, or their Age and Duration, we ſhall find it wonderful. For why ſhould ſome Plants riſe up to a great height, others creep upon the ground, which perhaps may have equal ſeeds, nay the leſſer Plant many times the greater ſeed? Why ſhould each particular ſo obſerve its kind, as conſtantly to produce the ſame Leaf for conſiſtency, figure, diviſion, and edging; and bring forth the ſame kind of Flower, and Fruit, and Seed, and that though you tranſlate it into a Soil which naturally puts forth no ſuch kind of Plant, ſo that it is ſome * λόγος σπερματικὸς which doth effect this or rather ſome intelligent *plaſtick Nature*, as we have before intimated. For what account can be given of the determination of the growth and magnitude of Plants from mechanical Principles, of *matter moved* without the preſidency and guidance of ſome ſuperiour Agent? Why may not Trees grow up as high as the Clouds or Vapours aſcend,

* *Seminal form or vertue.*

or

or if you ſay the Cold of the ſuperiour Air checks them, why may they not ſpread and extend their lateral Branches ſo far till their diſtance from the Center of Gravity depreſs them to the Earth, be the Tree never ſo high? How comes it to paſs that though by Culture and Manure they may be highly improved, and augmented to a double, treble, nay ſome a much greater proportion in magnitude of all their Parts; yet is this advance reſtrained within certain limits? There is a *maximum quod ſic* which they cannot exceed. You can by no Culture or Art extend a *Fennel Stalk* to the ſtature and bigneſs of an *Oak*. Then why ſhould ſome be very long lived, others only Annual or Biennial? How can we imagine that any Laws of Motion can determine the *ſituation* of the *leaves*, to come forth by pairs, or alternately, or circling the ſtalk; the *flowers* to grow ſingly, or in company and tufts, to come forth the boſoms of the leaves and branches, or on the tops of branches and ſtalks; the *figure* of the leaves, that they ſhould be divided into ſo many jags or eſcallops and curiouſly indented round the edges, as alſo of the flower-leaves, their number and ſite, the figure and number of the *ſtamina* and their *apices*, the figure of the *Style* and Seed-veſſel, and the number of Cels into which it is divided.

That

That all this be done, and all theſe parts duly proportioned one to another, there ſeems to be neceſſary ſome intelligent *Plaſtick Nature*, which may underſtand and regulate the whole Oeconomy of the Plant: For this cannot be the Vegetative Soul, becauſe that is material and diviſible together with the Body: Which appears in that a Branch cut off of a Plant will take Root and grow and become a perfect Plant it ſelf, as we have already obſerved. I had almoſt forgotten the complication of the Seed-leaves of ſome Plants in the Seed, which is ſo ſtrange that one cannot believe it to be done by Matter however moved by any Laws or Rules imaginable. Some of them being ſo cloſe plaited, and ſtraitly folded up and thruſt together within the membranes of the Seed, that it would puzzle a man to imitate it, and yet none of the folds ſticking or growing together; ſo that they may eaſily be taken out of their caſes, and ſpread and extended even with ones Fingers.

Secondly, If we conſider each particular Part of a Plant, we ſhall find it not without its End or Uſe: The *Roots* for its ſtability and drawing nouriſhment from the Earth. The *Fibres* to contain and convey the Sap. Beſides which there is a large ſort of Veſſels to contain the proper and

ſpecific

ſpecific Juice of the Plant: and others to carry Air for ſuch a kind of Reſpiration as it needeth; of which we have already ſpoken. The outer and inner Bark in Trees ſerve to defend the Trunk and Boughs from the exceſſes of Heat and Cold and Drought, and to convey the Sap for the Annual augmentation of the Tree. For in truth every Tree may in ſome ſence be ſaid to be an Annual Plant, both Leaf, Flower and Fruit proceeding from the Coat that was ſuperinduced over the Wood the laſt Year, which Coat alſo never beareth any more, but together with the old Wood ſerves as a Form or Block to ſuſtain the ſucceeding annual Coat. The *Leaves* before the *Gemma* or Bud be explicated to embrace and defend, the Flower and Fruit, which is even then perfectly formed; afterwards to preſerve the Branches, Flowers and Fruit from the Injuries of the Summer Sun, which would too much parch and dry them, if they lay open and expoſed to its Beams without any Shelter; the Leaves I ſay qualifie and contemper the Heat, and ſerve alſo to hinder the too haſty evaporation of the moiſture about the Root; not to mention the pleaſant and delectable, cooling and refreſhing Shade they afford in the Summer time; which was very much eſteemed by the Inhabitants of hot Coun-

tries,

tries, who always took great delight and pleaſure to ſit in the open Air under ſhady Trees: Hence that expreſſion ſo often repeated in Scripture, of every Mans *ſitting under his own Vine, and under his own Fig-Tree*, where alſo they uſed to eat; as appears by *Abrahams* entertaining the Angels under a Tree, and ſtanding by them when they did eat. *Gen.* 18. 8. Moreover the Leaves of Plants are very beautiful and ornamental. That there is great pulchritude and comlineſs of Proportion in the Leaves, Flowers and Fruits of Plants, is atteſted by the general Verdict of Mankind, as Dr. *More* and others well obſerve. The adorning and beautifying of Temples and Buildings in all Ages, is an evident and undeniable Teſtimony of this. For what is more ordinary with *Architects* than the taking in Leaves and Flowers and Fruitage for the garniſhing of their Work; as the *Roman* the Leaves of *Acanthus ſat.* and the *Jewiſh* of *Palm-Trees* and *Pomegranates*; and theſe more frequently than any of the five regular Solids, as being more comly and pleaſant to behold. If any man ſhall object, that comlineſs of Proportion and Beauty is but a meer conceit, and that all Things are alike handſom to ſome men who have as good Eyes as others; and that this

appears

appears by the variation of Fashions, which doth so alter mens Fancies, that what erewhile seemed very handsom and comly, when it is once worn out of Fashion appears very absurd, uncouth and ridiculous. To this I answer, that Custom and Use doth much in those Things where little of Proportion and Symmetry shew themselves, or which are alike comly and beautiful, to disparage the one, and commend the other. But there are degrees of things; for (that I may use * Dr. *Mores* Words) I dare appeal to any man that is not sunk into so forlorn a pitch of degeneracy that he is as stupid to these things as the basest of Beasts, whether, for example, a rightly cut *Tetraedrum*, *Cube* or *Icosaedrum* have no more Pulchritude in them than any rude broken Stone, lying in the field or high-ways; or to name other solid Figures, which though they be not regular properly so called, yet have a settled *Idea* and Nature, as a *Cone*, *Sphere*, or *Cylinder*, whether the sight of those do not more gratifie the minds of Men, and pretend to more elegancy of shape than those rude cuttings or chippings of Freestone that fall from the Masons hands, and serve for nothing but to fill up the middle of the Wall, as fit to be hid from the Eyes of Men for their uglinesse. And therefore it is observable,

* *Antidote against Athism* l. 2. c. 5.

vable, that if Nature ſhape any thing but near to this *Geometrical* accuracy, that we take notice of it with much content and pleaſure, and greedily gather and treaſure it up. As if it be but exactly round, as thoſe Spherical Stones found in *Cuba*, and ſome alſo in our own Land, or have but its ſides parallel, as thoſe rhomboideal *Selenites* found near St. *Ives* in *Huntington-ſhire*, and many other places in *England*. Whereas ordinary Stones of rude and uncertain Figures we paſs by, and take no notice of at all. But though the Figures of theſe Bodies be pleaſing and agreable to our Minds, yet (as we have already obſerved) thoſe of the Leaves, Flowers and Fruits of Trees, more. And it is remarkable, that in the Circumſcription and Complication of many Leaves, Flowers, Fruits, and Seeds Nature affects a regular Figure. Of a pentagonal or quincuncial Diſpoſition Sir *Tho. Brown* of *Norwich* produces ſeveral examples in his Diſcourſe about the *Quincunx*. And doubtleſs inſtances might be given in other regular Figures, were men but obſervant.

The *Flowers* ſerve to cheriſh and defend the firſt and tender Rudiments of the Fruit: I might alſo add the maſculine or prolifick Seed contained in the chives or *apices* of the *ſtamina*. Theſe beſide the elegancy of their Figures

gures are many of them endued with ſplendid and lovely Colours, and likewiſe moſt grateful and fragrant Odours. Indeed ſuch is the beauty and luſtre of ſome Flowers, that our Saviour ſaith of the *Lilies* of the Field (which ſome not without reaſon ſuppoſe to have been *Tulips*) that *Solomon in all his glory was not arrayed like one of theſe.* And it is obſerved by * *Spigelius*, That the Art of the moſt skilful Painter cannot ſo mingle and temper his Colours, as exactly to imitate or counterfeit the native ones of the Flowers of *Vegetables.*

* *Iſag. ad rem Herbariam.*

As for the *Seeds* of *Plants*, * Dr. *More* eſteems it an evident Sign of Divine Providence, that every Kind hath its Seed. For it being no neceſſary reſult of the motion of the matter (as the whole contrivance of the Plant indeed is not) and it being of ſo great conſequence that they have Seed for the continuance and propagation of their own Species, and alſo for the gratifying mans Art, Induſtry and Neceſſities (for much of Husbandry and Gardening lies in this) it cannot but be an Act of Counſel to furniſh the ſeveral Kinds of Plants with their Seeds.

* *Antidote againſt Atheiſm* . l. 2. c. 6.

Now the *Seed* being ſo neceſſary for the maintenance and increaſe of the ſeveral *Species*, it is worthy the obſervation, what Care is taken to ſecure and preſerve it, being in

ſome doubly and trebly defended. As for inſtance, in the *Walnut*, *Almond* and *Plums* of all ſorts, we have firſt a thick pulpy covering, then a hard ſhell, within which is the Seed encloſed in a double membrane. In the *Nutmeg* another Tegument is added beſides all theſe, *viz.* the *Mace* within the hard Shell immediately inveloping the Kernel. Neither yet doth the exterior Pulp of the Fruit or *Pericarpium* ſerve only for the defence and ſecurity of the Seed, whilſt it hangs upon the Plant: But after it is mature and faln upon the Earth, for the ſtercoration of the Soil, and promotion of the growth, though not the firſt germination of the Seminal Plant. Hence (as * *Petrus de Creſcentiis* tells us) Husbandmen to make their Vines bear, Manure them with Vine-leaves, or the Husks of expreſſed Grapes, and that they obſerve thoſe to be moſt fruitful, which are ſo manured with their own: Which Obſervation holds true alſo in all other Trees and Herbs. But beſides this uſe of the Pulp or *Pericarpium* for the guard and benefit of the Seed, it ſerves alſo by a ſecondary intention of Nature in many Fruits for the Food and Suſtenance of Man and other Animals.

* *Agric.* l. 2. c. 6.

Another thing worthy the noting in *Seeds*, and argumentative of Providence and Deſign,

is

is that pappoſe Plumage growing upon the Tops of ſome of them, whereby they are capable of being wafted with the Wind, and by that means ſcattered and diſſeminated far and wide.

Furthermore moſt *Seeds* having in them a ſeminal Plant perfectly formed, as the Young is in the Womb of Animals, the elegant complication thereof in ſome *Species* is a very pleaſant and admirable Spectacle; ſo that no man that hath a Soul in him can imagine or believe it was ſo formed and folded up without Wiſdom and Providence. But of this I have ſpoken already.

Laſtly, the immenſe Smalneſs of ſome Seeds, not to be ſeen by the naked Eye, ſo that the number of Seeds produced at once in ſome one Plant may amount to a Million, is a convincing Argument of the infinite Underſtanding and Art of the Former of them.

And it is remarkable that ſuch *Moſſes* as grow upon Walls, the Roofs of Houſes and other high Places, have Seeds ſo exceſſively ſmall, that when ſhaken out of their Veſſels they appear like Vapor or Smoak, ſo that they may either aſcend of themſelves, or by an eaſie impulſe of the Wind be raiſed up to the Tops of Houſes, Walls or Rocks: And we need not won-

der how the Moſſes got thither, or imagine they ſprung up ſpontaneouſly there.

I might alſo take notice of many other particulars concerning Vegetables, as, Firſt, That becauſe they are deſigned for the Food of Animals, therefore Nature hath taken more extraordinary Care and made more abundant Proviſion for their Propagation and increaſe; ſo that they are multiplied and propagated not only by the Seed, but many alſo by the Root, producing Off ſets or creeping under Ground, many by Strings or Wires running above Ground, as *Strawberry* and the like, ſome by Slips or Cuttings, and ſome by ſeveral of theſe Ways. Secondly, That ſome ſorts of Plants, as *Vines*, all ſorts of *Pulſe*, *Hops*, *Briony*, all Pomiferous Herbs, *Pumpions*, *Melons*, *Gourds*. *Cucumbers*, and divers other *Species*, that are weak and unable to raiſe or ſupport themſelves, are either endued with a faculty of twining about others that are near, or elſe furniſhed with Claſpers and Tendrels, whereby as it were with Hands they catch hold of them and ſo ramping upon Trees, Shrubs, Hedges or Poles, they mount up to a great height, and ſecure themſelves and their Fruit. Thirdly, That others are armed with Prickles and Thorns, to ſecure them from the brow-

ſing

ſing of Beaſts, as alſo to ſhelter others that grow under them. Moreover they are hereby rendred very uſeful to Man, as if deſigned by Nature to make both Quick and Dead Hedges and Fences, The great Naturaliſt *Pliny*, hath given an ingenious Account of the Providence and Deſign of Nature in thus arming and fencing them in theſe Words. *Inde* (ſpeaking of Nature) *excogitavit aliquas aſpectu hiſpidas, tactu truces, ut tantùm non vocem ipſius Naturæ fingentis illas, rationémque reddentis exaudire videamur, ne ſe depaſcat avida quadrupes, ne procaces manus rapiant, ne neglecta veſtigia obterant, ne inſidens ales infringat; his muniendo aculeis telíſque armando, remediis ut ſalva ac tuta ſint. Ità hoc quoque quod in iis odimus hominum causâ excogitatum eſt.*

As for the Signatures of Plants, or the Notes impreſſed upon them as *Indices* of their Virtues, though *ſome lay great ſtreſs upon them, accounting them ſtrong Arguments to prove that ſome underſtanding Principle is the higheſt Original of the Works of Nature; as indeed they were, could it certainly be made appear that there were ſuch Marks deſignedly ſet upon them; becauſe all that I find mentioned and collected by Authors, ſeem to me to be ra-

* *D.* More *Antid.* l. 2. c. 6.

ther fancied by men, than deſigned by Nature to ſignifie or point out any ſuch Vertues or Qualities as they would make us believe, I have elſewhere, I think upon good Grounds, rejected them; and finding no reaſon as yet to alter my Opinion, I ſhall not further inſiſt on them.

Of Bodies endued with a Senſitive Soul, or Animals.

I proceed now to the conſideration of Animate Bodies indued with a Senſitive Soul, called *Animals*. Of theſe I ſhall only make ſome general Obſervations, not curiouſly conſider the Parts of each particular *Species*, ſave only as they ſerve for Inſtances or Examples.

Firſt of all, becauſe it is the great deſign of Providence to maintain and continue every *Species*, I ſhall take notice of the great Care and abundant Proviſion that is made for the ſecuring this End. *Quanta ad eam rem vis, ut in ſuo quæque genere permaneat? Cic.* Why can we imagine all Creatures ſhould be made Male and Female but to this purpoſe? Why ſhould there be implanted in each Sex ſuch a vehement and inexpugnable Appetite of Copulation? Why in viviparous Animals, in the time

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of Geſtation ſhould the nouriſhment be carried to the *Embryon* in the Womb, which at other times goeth not that way? When the Young is brought forth, how comes all the nouriſhment then to be transferred from the Womb to the Breaſts or Paps, leaving its former channel, the Dam at ſuch time being for the moſt part Lean and Ilfavoured? Here I cannot omit one very remarkable Obſervation I find in *Cicero*. *Atq; ut intelligamus* (ſaith he) *nihil horum eſſe fortuitum, ſed hæc omnia providæ ſolertiſq; naturæ, Quæ multiplices fœtus procreant, ut Sues, ut Canes, his mammarum data eſt multitudo, quas eaſdem paucas habent eæ beſtiæ quæ pauca gignunt.* *That we may underſtand that none of theſe things* (he had been ſpeaking of) *is fortuitous, but that all are the effects of provident and ſagacious Nature, multiparous quadrupeds, as Dogs, as Swine, are furniſhed with a multitude of Paps: Whereas thoſe Beaſts which bring forth few have but a few.*

That Flying Creatures of the greater ſort, that is *Birds* ſhould all lay Eggs, and none bring forth Live Young, is a manifeſt Argument of Divine Providence, deſigning thereby their Preſervation and Security; that there might be the more plenty of them; and that neither the Birds of Prey, the Serpent, nor the Fowler ſhould ſtraiten their Gene-

rations too much. For if they had been Viviparous, the Burthen of their Womb, if they had brought forth any competent number at a time, had been so great and heavy, that their Wings would have failed them, and they became an easie Prey to their Enemies: Or if they had brought but one or two at a time, they would have been troubled all the Year long with Feeding their Young, or Bearing them in their Womb. * *Dr. More.*

Antid. Atheism. l. 2. c. 9.

This mention of Feeding their Young puts me in mind of two or three considerable Observations referring thereto.

First, Seeing it would be for many reasons inconvenient for Birds to give Suck, and yet no less inconvenient if not destructive to the Chicken upon exclusion all of a sudden to make so great a change in its Diet, as to pass from liquid to hard Food, before the Stomach be gradually consolidated and by use strengthened and habituated to grind and concoct it, and its tender and pappy Flesh, fitted to be nourished by such strong and solid Diet; and before the Bird be by little and little accustomed to use its Bill, and gather it up, which at first it doth but very slowly and imperfectly; therefore Nature hath provided a large Yolk in every Egg; a great part whereof remaineth after the Chicken is hatch'd, and is taken up and

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encloſed in its Belly, and by a channel made on purpoſe received by degrees into the Guts, and ſerves inſtead of Milk to nouriſh the Chick for a conſiderable time; which nevertheleſs mean while feeds it ſelf by the Mouth a little at a time, and gradually more and more, as it gets a perfecter Ability and Habit of gathering up its Meat, and its Stomach is ſtrengthen'd to macerate and concoct it, and its Fleſh hardened and fitted to be nouriſhed by it.

Secondly, That Birds which feed their Young in the Neſt, though in all likelyhood they have no ability of counting the number of them, ſhould yet, (though they bring but one morſel of Meat at a time, and have not fewer (it may be) than ſeven or eight Young in the Neſt together, which at the return of their Dams, do all at once with equal greedineſs, hold up their Heads and gape,) not omit or forget one of them, but feed them all; which, unleſs they did carefully obſerve, and retain in Memory which they had fed, which not, were impoſſible to be done; this I ſay, ſeems to me moſt ſtrange and admirable, and beyond the poſſibility of a meer Machine to perform.

Thirdly, the marvellous ſpeedy growth of Birds that are hatched in Neſts, and fed by the Old ones there, till they be fledg'd and come almoſt to their full bigneſs; at which

which perfection they arrive within the short term of about one Fortnight, seems to me an Argument of Providence designing thereby their preservation, that they might not lie long in a condition exposed to the ravine of any Vermine that may find them, being utterly unable to escape or shift for themselves.

Another and no less effectual Argument may be taken from the Care and Providence used for the hatching and rearing their young. and First, they search out a secret and quiet Place, where they may be secure and undisturbed in their incubation: Then they make themselves Nests, every one after his kind, that so their Eggs and Young may lie soft and warm, and their exclusion and growth be promoted. These Nests some of them so elegant and artificial, that it is hard for man to imitate them and make the like. I have seen Nests of an *Indian* Bird so artificially composed of the Fibres, I think, of some Roots, so curiously interwoven and platted together as is admirable to behold: Which Nests they hang on the ends of the Twigs of Trees over the Water, to secure their Eggs and Young from the ravage of *Apes* and *Monkeys*, and other Beasts that might else prey upon them. After they have laid their Eggs, how diligently and patiently do they

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ſit upon them till they be hatched, ſcarce affording themſelves time to go off to get them Meat? Nay with ſuch an ardent and impetuous deſire of ſitting are they inſpired, that if you take away all their Eggs, they will ſit upon an empty Neſt: And yet one would think that ſitting were none of the moſt pleaſant Works. After their Young are hatcht for ſome time they do almoſt conſtantly Brood them under their Wings, leſt the Cold, and ſometimes perhaps the Heat, ſhould harm them. All this while alſo they labor hard to get them Food, ſparing it out of their own Bellies, and pining themſelves almoſt to Death rather than they ſhould want. Moreover it is admirable to obſerve with what courage they are at that time inſpired, that they will even venture their own Lives in defence of them. The moſt timorous, as *Hens* and *Geeſe*, become then ſo couragious as to dare to fly in the Face of a man that ſhall moleſt or diſquiet their Young, which would never do ſo much in their own defence. Theſe things being contrary to any motions of Senſe, or inſtinct of Self-preſervation, and ſo eminent pieces of Self-denial, muſt needs be the Work of Providence for the continuation of the Species and upholding of the World. Eſpecially if we

conſider that all this Pains is beſtowed upon a thing which takes no notice of it, will render them no thanks for it, nor make them any requital or amends; and alſo, that after the young is come to ſome growth, and able to ſhift for it ſelf, the old one retains no ſuch στοργὴ to it, takes no further care of it, but will fall upon it, and beat it indifferently with others. To theſe I ſhall add one Obſervation more, relating to this Head, borrowed of Dr. *Cudworth*, Syſtem, *pag.* 69. One thing neceſſary to the Conſervation of the *Species* of Animals; that is, the keeping up conſtantly in the World a due numerical Proportion between the Sexes of *Male* and *Female*, doth neceſſarily infer a ſuperintending Providence. For did this depend only upon Mechaniſm, it cannot well be conceived, but that in ſome Ages or other, there ſhould happen to be all *Males*, or all *Females*; and ſo the Species fail. Nay, it cannot well be thought otherwiſe, but that there is in this a Providence, ſuperiour to that of the *Plaſtick* or *Spermatick Nature*, which hath not ſo much of Knowledge and Diſcretion allowed to it, as whereby to be able alone to govern this Affair.

Secondly, I ſhall take notice of the various ſtrange Inſtincts of Animals; which will neceſſarily demonſtrate, that they are directed

rected to Ends unknown to them, by a Wiſe Superintendent. As 1. That all Creatures ſhould know how to defend themſelves, and offend their Enemies; where their natural Weapons are ſituate, and how to make uſe of them. A *Calf* will ſo manage his Head as though he would puſh with his Horns even before they ſhoot. A *Boar* knows the uſe of his Tuſhes; A *Dog* of his Teeth; A *Horſe* of his Hoofs; A *Cock* of his Spurs; A *Bee* of her Sting; A *Ram* will but with his Head, yea though he be brought up tame, and never ſaw that manner of fighting. Now, why another Animal which hath no Horns ſhould not make a ſhew of puſhing, or no Spurs of ſtriking with his Legs and the like, I know not, but that every kind is providentially directed to the uſe of its proper and natural Weapons. 2. That thoſe Animals that are weak, and have neither Weapons nor Courage to fight, are for the moſt part created Swift of Foot or Wing, and ſo being naturally timorous, are both willing and able to ſave themſelves by flight. 3. That Poultrey, Partridge and other Birds ſhould at the firſt ſight know Birds of Prey, and make ſign of it by a peculiar note of their Voice to their young, who preſently thereupon hide themſelves: That the Lamb ſhould acknowledge

ledge the Wolf its Enemy, though it had never ſeen one before, as is taken for granted by moſt Naturaliſts, and may for ought I know be true, argues the Providence of Nature, or more truly the God of Nature, who for their preſervation hath put ſuch an Inſtinct into them. 4. That young Animals, ſo ſoon as they are brought forth, ſhould know their Food. As For Example, Such as are nouriſhed with Milk, preſently find their way to the Paps, and ſuck at them, whereas none of thoſe that are not deſigned for that nouriſhment ever offer to ſuck, or to ſeek out any ſuch food. Again, 5. That ſuch Creatures as are whole-footed or fin-toed, *viz.* ſome Birds and ſome Quadrupeds, are naturally directed to go into the water and ſwim there, as we ſee *Ducklings*, though hatch'd and led by a Hen, if ſhe brings them to the brink of a River or Pond of Water, they preſently leave her, and in they go, though they never ſaw any ſuch thing done before; and though the Hen clocks and calls, and doth what ſhe can to keep them out: So that we ſee every part in Animals is fitted to its Uſe, and the Knowledge of this Uſe put into them. For neither do any ſort of web-footed Fowls live conſtantly upon the Land, or fear to enter the Water, nor any Land-

Fowl

Fowl ſo much as attempt to ſwim there. 6. Birds of the ſame Kind make their Neſts of the ſame Materials, laid in the ſame Order, and exactly of the ſame Figure, ſo that by the ſight of the Neſt one may certainly know what Bird it belongs to. And this they do, though living in diſtant Countries, and though they never ſaw, nor could ſee any Neſt made, that is, though taken out of the Neſt, and brought up by hand; neither were any of the ſame kind ever obſerved to make a different Neſt either for Matter or Faſhion. This together with the curious and artificial Contexture of ſuch Neſts, and their fitneſs and convenience for the reception, hatching and cheriſhing the Eggs and Young of their reſpective builders (which we have before taken notice of) is a great Argument of a ſuperiour Author of their and others Natures, who hath indu'd them with theſe Inſtincts, whereby they are as it were, acted and driven to bring about Ends which themſelves aim not at (ſo far as we can diſcern) but are directed to; for (as *Ariſtotle* obſerves) οὔτε τέχνῃ, οὔτε ζητήσαντα, οὔτε βουλευσάμενα ποιεῖ, *They act not by any Art, neither do they enquire, neither do they deliberate about what they do.* And therefore, as Dr. *Cudworth* ſaith well, they are not Maſters of that Wiſdom according

according to which they act, but only paſſive to the Inſtincts and Impreſſes thereof upon them. And indeed to affirm that brute Animals do all theſe things by a Knowledge of their own, and which themſelves are Maſters of, and that without Deliberation and Conſultation, were to make them to be endued with a moſt perfect Intellect, far tranſcending that of Human Reaſon: Whereas it is plain enough, that Brutes are not above Conſultation but below it; and that theſe Inſtincts of Nature in them, are nothing but a kind of Fate upon them. 7. The *Bee*, a Creature of the loweſt form of Animals, ſo that no man can ſuſpect it to have any conſiderable meaſure of Underſtanding, or to have Knowledge of, much leſs to aim at any End, yet makes her Combs and Cells with that Geometrical Accuracy, that ſhe muſt needs be acted by an Inſtinct implanted in her by the wiſe Author of Nature. For firſt, ſhe plants them in a perpendicular poſture, and ſo cloſe together as with conveniency they may, beginning at the top, and working downwards, that ſo no room may be loſt in the Hive, and that ſhe may have eaſie acceſs to all the Combs and Cells. Beſides, the Combs being wrought double, that is, with Cells on each ſide, a common bottom or partition-

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wall could not in any other ſite have ſo conveniently, if at all, received or contained the Honey. Then ſhe makes the particular Cells moſt Geometrically and Artificially, as the famous Mathematician *Pappus* demonſtrates in the Preface to his third Book of *Mathematical* Collections. Firſt of all (ſaith he, ſpeaking of the Cells,) It is convenient that they be of ſuch figures as may cohere one to another, and have common ſides, elſe there would be empty ſpaces left between them to no uſe, but to the weakening and ſpoiling of the work, if any thing ſhould get in there. And therefore though a round figure be moſt capacious for the Honey, and moſt convenient for the *Bee* to creep into, yet did ſhe not make choice of that, becauſe then there muſt have been triangular ſpaces left void. Now there are only three rectilineous and ordinate figures which can ſerve to this purpoſe; and inordinate or unlike ones muſt have been not only leſs elegant and beautiful but unequal. [Ordinate Figures are ſuch as have all their Sides and all their Angles equal.] The three Ordinate Figures, are *Triangles*, *Squares*, and *Hexagons*. For the ſpace about any point may be filled up either by ſix equilateral *Triangles*, or four *Squares*, or three *Hexagons*; whereas three Pentagons are too little and three Heptagons too much. Of

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these three the Bee makes use of the *Hexagon*, both because it is more capacious than either of the other, provided they be of equal compass, and so equal matter spent in the construction of each: And Secondly, Because it is most commodious for the Bee to creep into: And Lastly, Because in the other Figures more Angles and Sides must have met together at the same point, and so the work could not have been so firm and strong. Moreover, the Combs being double, the Cells on each side the partition are so ordered, that the Angles on one side, insist upon the Centers of the bottoms of the Cells on the other side, and not Angle upon, or against Angle; which also must needs contribute to the strength and firmness of the work. Another sort of Bee I have observed, it may be called the *Tree-Bee*, whose industry is admirable in making provision for her young. First, She digs round Vaults or Burrows [*Cuniculos*] in a rotten or decayed Tree, of a great length, in them she builds or forms her cylindrical Nests or Cases, resembling Cartrages, or a very narrow Thimble, only in proportion longer, of pieces of Rose or other Leaves which she shares off with her mouth, and plats and joyns close together by some glutinous Substance. These Cases she fills with a red Pap, of a thinner consistence than

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an Electuary, of no pleasant taste, which where she gathers, I know not: On the top of the Pap, she lays one Egg, and then closes up the Vessel with a cover of leaves. The enclosed Egg soon becomes an *Eala* or Maggot, which feeding upon the Pap till it comes to its full growth changes to a *Nympha*, and after comes out a Bee. Another Insect noted for her seeming prudence, in making provision for the Winter, proposed by *Solomon* to the Sluggard for his imitation, is the *Ant*, which (as all Naturalists agree) hoards up grains of Corn against the Winter for her Sustenance: And is reported by some to * bite off the *germen* of them, lest they should sprout by the moisture of the Earth, which I look upon as a mere fiction; neither should I be forward to credit the former relation, were it not for the Authority of the *Scripture*, because I could never observe any such storing up of Grain by our Country-Ants.

* *Plin.* l. 11. c. 30.

Yet is there a Quadruped taken notice of even by the vulgar for laying up in store provision for the Winter, that is, the *Squirrel*, whose hoards of Nuts are frequently found and pillaged by them.

The *Beaver* is by credible persons Eye-witnesses affirmed to build him Houses for shelter and security in Winter-time: See Mr. *Boyl* of *Final Causes*.

Beſides theſe I have mentioned, an Hundred others may be found in Books relating eſpecially to Phyſick; as that *Dogs* when they are Sick ſhould vomit themſelves by eating Graſs: That *Swine* ſhould refuſe Meat ſo ſoon as they feel themſelves ill, and ſo recover by Abſtinence: That the Bird *Ibis* ſhould teach Men the way of adminiſtring Clyſters. *Plin. lib.* 8. *cap.* 27. The wild *Goats* of *Dictamnus* for drawing out of Darts, and healing Wounds: The *Swallow* the uſe of *Celandine* for repairing the Sight, *&c. ibid.* Of the truth of which becauſe I am not fully ſatisfied, I ſhall make no Inference from them.

Thirdly, I ſhall remark the Care that is taken for the preſervation of the Weak and ſuch as are expoſed to Injuries, and preventing the encreaſe of ſuch as are noiſom and hurtful: For as it is a Demonſtration of the divine Power and Magnificence to create ſuch variety of Animals, not only great but ſmall, not only ſtrong and couragious, but alſo weak and timerous; ſo is it no leſs Argument of his Wiſdom to give to theſe Means, and the Power and Skill of uſing them, to preſerve themſelves from the violence and Injuries of thoſe. That of the weak ſome ſhould dig Vaults and Holes in the Earth, as *Rabbets*, to ſe-

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cure themſelves and their Young; others ſhould be armed with hard Shels; others with Prickles, the reſt that have no ſuch armature ſhould be endued with great Swiftneſs or Pernicity: And not only ſo, but ſome alſo have their Eyes ſtand ſo prominent, as the *Hare*, that they can ſee as well behind as before them, that ſo they may have their Enemy always in their Eye; and long, hollow, moveable Ears, to receive and convey the leaſt ſound, or that which comes from far, that they be not ſuddenly ſurpriſed or taken (as they ſay) napping. As for *Sheep*, which have no natural Weapons or Means to defend or ſecure themſelves, neither Heels to run nor claws to dig; they are delivered into the Hand, and committed to the care and tuition of Man, and ſerving him for divers Uſes, are nouriſhed and protected by him; and ſo enjoying their Beings for a time, by this means propagate and continue their Species: So that there are none deſtitute of ſome Means to preſerve themſelves and their kind; and theſe Means ſo effectual, that notwithſtanding all the endeavors and contrivances of Man and Beaſt to deſtroy them, there is not to this day one *Species* loſt of ſuch as are mentioned in Hiſtories, and conſequently and undoubtedly neither of ſuch as were at firſt created.

Then for Birds of Prey and rapacious Animals, it is remarkable what *Ariſtotle* obſerves, That they are all ſolitary, and go not in Flocks, Γαμψωνύχων ἐδὲν ἀγελαῖον. No Birds of Prey are gregarious. Again, That ſuch Creatures do not greatly multiply τῶν γαμψωνύχων ὀλιγοτόκα πφύτα. They for the moſt part breeding and bringing forth but one or two, or at leaſt a few young ones at once: Whereas they that are feeble and timorous are generally multiparous; or if they bring forth but few at once, as *Pigeons*, they compenſate that by their often breeding, *viz.* every Month but two throughout the Year; by this means providing for the continuation of their kind.

Fourthly, I ſhall note the exact Fitneſs of the Parts of the Bodies of Animals to every ones Nature and manner of living. Of this Dr. * *More* produces an eminent Inſtance in a poor contemptible Quadruped, the *Mole*. Firſt of all (ſaith he) her dwelling being under ground, where nothing is to be ſeen, Nature hath ſo obſcurely fitted her with Eyes, that Naturaliſts can ſcarcely agree, whether ſhe hath any Sight at all or no [In our Obſervation, *Moles* have perfect Eyes, and holes for them through the Skin, ſo that they are outwardly to be ſeen by any that ſhall diligently

* *Antidote againſt Atheiſm* l. 2. c. 10.

diligently ſearch for them; though indeed they are exceeding ſmall, not much bigger than a great Pins head.] But for amends, what ſhe is capable of for her defence and warning of danger, ſhe has very eminently conferred upon her; for ſhe is very quick of hearing [doubtleſs her ſubterraneous Vaults are like Trunks to convey any Sound a great way.] And then her ſhort Tail, and ſhort Legs, but broad fore-Feet armed with ſharp Claws, we ſee by the event to what purpoſe they are, ſhe ſo ſwiftly working her ſelf under Ground, and making her way ſo faſt in the Earth, as they that behold it cannot but admire it. Her Legs therefore are ſhort that ſhe need dig no more than will ſerve the mere thickneſs of her Body: And her fore-Feet are broad, that ſhe may ſcoup away much Earth at a time: And ſhe has little or no Tail, becauſe ſhe courſes it not on the Ground like a *Rat* or *Mouſe*, but lives under the Earth, and is fain to dig her ſelf a dwelling there; and ſhe making her way through ſo thick an Element, which will not eaſily yield as the Water and Air do; it had been dangerous to draw ſo long a train behind her; for her Enemy might fall upon her rear, and fetch her out before ſhe had perfected and got full Poſſeſſion of her

Works: Which being ſo, what more palpable Argument of Providence than She?

Another inſtance in Quadrupeds might be the *Tamandua* or *Ant-Bear*, deſcribed by *Marcgrave* and *Piſo*, who ſaith of them, that they are Night-walkers, and ſeek their Food by Night. Being kept tame they are fed with Fleſh, but it muſt be minced ſmall, becauſe they have not only a ſlender and ſharp Head and Snout, but alſo a narrow and toothleſs Mouth; their Tongue is like a great Lute-ſtring (as big as a Gooſe-quill) round, and in the greater Kind (for there are two *Species*) more than two foot long, and therefore lies doubled in a Channel between the lower parts of the Cheeks. This when hungry they thruſt forth, being well moiſtened, and lay upon the Trunks of Trees, and when it is covered with *Ants* ſuddenly draw it back into their Mouths; if the *Ants* lie ſo deep that they cannot come at them, they dig up the Earth with their long and ſtrong Claws, wherewith for that purpoſe their fore-Feet are armed. So we ſee how their Parts are fitted for this kind of Diet, and no other; for the catching of it and for the eating of it, it requiring no comminution by the Teeth, as appears alſo in the *Chamæleon*, which is

another

another Quadruped that imitates the *Tamandua* in this property of darting out the Tongue to a great length, with wonderful celerity, and for the ſame purpoſe too of catching of Inſects.

Beſides theſe Quadrupeds, there are a whole Genus of *Birds*, called *Pici Martii* or *Woodpeckers*, that in like manner have a Tongue which they can ſhoot forth to a very great length, ending in a ſharp ſtiff bony tip, dented on each ſide; and at pleaſure thruſt it deep into the holes, clefts and crannies of Trees, to ſtab and draw out *Coſſi* or any other Inſects lurking there, as alſo into Anthills, to ſtrike and fetch out the *Ants* and their Eggs. Moreover they have ſhort but very ſtrong Legs, and their Toes ſtand two forwards two backwards, which diſpoſition (as *Aldrovandus* well notes) Nature, or rather the Wiſdom of the Creator, hath granted to *Woodpeckers*, becauſe it is very convenient for the climbing of Trees, to which alſo conduces the ſtiffneſs of the Feathers of their Tails and there bending downward, whereby they are fitted to ſerve as a prop for them to lean upon and bear up their Bodies. As for the *Chamæleon* he imitates the *Woodſpite*, not only in the make, motion and uſe of his Tongue for ſtriking *Ants*, *Flies*, and

and other Insects; but also in the site of his Toes, whereby he is wonderfully qualified to run upon Trees, which he doth with that swiftness, that one would think he flew, whereas upon the ground he walks very clumsily and ridiculously. A full description of the outward and inward parts of this Animal, may be seen at the end of *Panarolus*'s *Observat.* It is to be noted, that the *Chamelion*, though he hath Teeth, uses them not for chewing his Prey, but swallows it immediately.

II. In *Birds* all the Members are most exactly fitted for the use of flying. First, The Muscles which serve to move the Wings are the greatest and strongest, because much force is required to the agitation of them; the underside of them is also made concave, and the upper convex, that they may be easily lifted up, and more strongly beat the Air, which by this means doth more resist the descent of their body downward. Then the Trunk of their body doth somewhat resemble the Hull of a Ship; the Head the Prow, which is for the most part small, that it may the more easily cut the Air, and make way for their bodies; the Train serves to steer, govern and direct their flight, and however it may be held erect in their standing or walking, yet is directed to lye almost in the same

ſame plain with their Backs, or rather a little inclining, when they fly. That the Train ſerves to ſteer and direct their flight, and turn their Bodies like the Rudder of a Ship is evident in the *Kite*, who by a light turning of his Train, moves his Body which way he pleaſes. *Iidem videntur artem gubernandi docuiſſe caudæ flexibus, in Cœlo monſtrante natura quod opus eſſet in profundo.* Plin. lib. 10. cap. 10. *They ſeem to have taught men the Art of ſteering a Ship by the flexures of their Tails; Nature ſhewing in the Air what was needful to be done in the Deep.* And it's notable that *Ariſtotle* truly obſerves, that whole-footed Birds, and thoſe that have long Legs, have for the moſt part ſhort Tails; and therefore whileſt they fly, do not as others draw them up to their Bellies, but ſtretch them at length backwards, that they may ſerve to ſteer and guide them inſtead of Tails. Neither doth the Tail ſerve only to direct and govern, the flight, but alſo partly to ſupport the Body and keep it even, wherefore when ſpread, it lies parallel to the horizon, and ſtands not perpendicular to it, as Fiſhes do. Hence Birds that have no Tails, as ſome ſorts of *Colymbi* or Douckers fly very inconveniently with their Bodies almoſt erect.

III. As for *Fishes* their Bodies are long and slender, or else thin for the most part, for their more easie swimming and dividing the water. The wind-bladder, wherewith most of them are furnished, serves to poise their Bodies, and keep them equiponderant to the water, which else would sink to the bottom, and lie grovelling there, as hath by breaking the Bladder been experimentally found. By the contraction and dilatation of this Bladder, they are able to raise or sink themselves at pleasure, and continue in what depth of water they list. The Fins made of gristly spokes or rays connected by Membranes, so that they may be contracted or extended like Womens fans, and furnished with Muscles for motion, serve partly for progression, but chiefly to hold the Body upright; which appears in that when they are cut off, it wavers to and fro, and so soon as the Fish dies, the Belly turns upward. The great strength by which Fishes dart themselves forward with incredible celerity, like an Arrow out of a Bow, lies in their Tails, their Fins mean time, lest they should retard their motion, being held close to their Bodies. And therefore almost the whole Musculous Flesh of the Body is bestowed upon the Tail and Back, and serves for the vibration of the Tail, the heaviness and corpulency

pulency of the Water, requiring a great force to divide it. I might here take notice of thoſe Amphibious Creatures, which we may call Aquatic Quadrupeds (though one of them there is that hath but two Feet, *viz.* the *Manati* or Sea-Cow) the *Beaver*, the *Otter*, the *Phoca* or *Sea-Calf*, the *Water-Rat*, and the *Frog*, the Toes of whoſe Feet are joyned by membranes, as in Water-Fowls for ſwimming; and who have very ſmall Ears, and Ear-holes, as the Cetaceous Fiſhes have for hearing in the Water.

To this head belongs the adapting of the parts that miniſter to Generation in the Sexes one to another; and in Creatures that nouriſh their Young with Milk, the Nipples of the Breaſt to the Mouth and Organs of Suction; which he muſt needs be wilfully blind and void of ſence, that either diſcerns not, or denies to be intended and made one for the other. That the Nipples ſhould be made ſpungy, and with ſuch perforations, as to admit paſſage to the Milk when drawn, otherwiſe to retain it; and the Teeth of the Young either not ſpungy, or ſo ſoft and tender, as not to hurt the Nipples of the Dam, are Effects and Arguments of Providence and Deſign.

To this head of the fitneſs of the parts of the Body to the Creatures Nature and manner

ner of living, belongs that observation of *Aristotle*, τῶν ὀρνίθων ὅσα μὲν γαμψώνυχα σαρκοφάγα πάντα. Such Birds as have crooked Beaks and Talons, are all carnivorous; and so of Quadrupeds, καρχαιόδοντα *carnivora omnia*. All that have serrate Teeth, are carnivorous. This observation holds true concerning all *European* Birds, but I know not but that *Parrots* may be an exception to it. Yet it is remarkable, that such Birds as are carnivorous have no Gizzard, or musculous, but a membranous Stomach; that kind of food needing no such grinding or comminution as Seeds do, but being torn into strings, or small flakes by the Beak, may be easily concocted by a membranous Stomach.

To the fitness of all the parts and members of Animals to their respective uses may also be referred another observation of the same *Aristotle*, Πάντα τὰ ζῶα ἀρτίους ἔχει πόδας. All Animals have even Feet, not more on one side than another; which if they had, would either hinder their walking, or hang by not only useless, but also burthensome. For though a Creature might make limping shift to hop, suppose with three Feet, yet nothing so conveniently or steddily to walk, or run, or indeed to stand. So that we see, Nature hath made choice

of

of what is moſt fit, proper and uſeful. They have alſo not only an even number of Feet, anſwering by pairs one to another, which is as well decent as convenient; but thoſe too of an equal length, I mean the ſeveral pairs; whereas were thoſe on one ſide longer than they on the other, it would have cauſed an inconvenient halting or limping in their going.

I ſhall mention but one more Obſervation of *Ariſtotle*, that is, Πτηνὸν μόνον ἓδέν, there is no Creature only volatile, or no flying Animal but hath Feet as well as Wings, a power of walking or creeping upon the Earth; becauſe there is no food, or at leaſt not ſufficient Food for them to be had always in the Air; or if in hot Countries we may ſuppoſe there is, the Air being never without ſtore of Inſects flying about in it, yet could ſuch Birds take no Reſt, for having no Feet, they could not perch upon Trees, and if they ſhould alight upon the Ground, they could by no means raiſe themſelves any more, as we ſee thoſe Birds which have but ſhort Feet, as the *Swift* and *Martinet*, with difficulty do. Beſides, they would want means of breeding, having no where to lay their Eggs, to Sit, Hatch or Brood their Young. As for the Story of the *Manucodiata* or *Bird* of *Paradiſe*, which in the

former

former Age was generally received and accepted for true, even by the Learned, it is now discovered to be a Fable, and rejected and exploded by all men: Those Birds being well known to have Legs and Feet, as well as others, and those not short, small not feeble ones, but sufficiently great and strong and armed with crooked Talons, as being the Members of Birds of Prey.

Object. But against the Uses of several Bodies I have instanced in that refer to Man it may be objected, that these uses were not designed by Nature in the formation of the things; but that the things were by the wit of Man accommodated to those Uses.

To which I answer with Dr. *More* in the *Appendix* to his *Antidote against Atheism.* That the several useful dependencies of this kind, (*viz.* of *Stones*, *Timber*, and *Metals* for building of Houses or Ships, the *Magnet* for Navigation, &c. Fire for melting of Metals and forging of Instruments for the purposes mentioned) we only find, not make them. For whether we think of it or no, it is, for Example, manifest, that Fuel is good to continue Fire, and Fire to melt Metals, and Metals to make Instruments to build Ships and Houses, and so on. Wherefore it being true, that there is such a subordinate

ordinate uſefulneſs in the Things themſelves that are made to our Hand, it is but reaſon in us to impute it to ſuch a Cauſe as was aware of the uſefulneſs and ſerviceableneſs of its own Works. To which I ſhall add, that ſince we find Materials ſo fit to ſerve all the Neceſſities and Conveniences, and to exerciſe and employ the Wit and Induſtry of an intelligent and active Being, and ſince there is ſuch an one created that is endued with Skill and Ability to uſe them, and which by their help is enabled to rule over and ſubdue all inferiour Creatures, but without them had been left neceſſitous, helpleſs and obnoxious to Injuries above any other; and ſince the omniſcient Creator could not but know all the Uſes, to which they might and would be employed by Man, to them that acknowledge the Being of a Deity, it is little leſs than a Demonſtration, that they were created intentionally, I do not ſay only, for thoſe uſes.

Methinks by all this Proviſion for the Uſe and Service of Man, the Almighty interpretatively ſpeaks to him in this manner, I have placed thee in a ſpacious and well furniſhed World, I have endued thee with an ability of underſtanding what is beautiful and proportionable, and have made that

which is ſo agreeable and delightful to thee; I have provided thee with Materials whereon to exerciſe and employ thy Art and Strength; I have given thee an excellent Inſtrument, the Hand, accommodated to make uſe of them all; I have diſtinguiſhed the Earth into Hills, and Valleys, and Plains, and Meadows, and Woods; all theſe parts capable of Culture and Improvement by thy Induſtry; I have committed to thee for thy aſſiſtance in thy labors of Plowing, and Carrying, and Drawing, and Travel; the laborious Ox, the patient Aſs, and the ſtrong and ſerviceable Horſe; I have created a multitude of Seeds for thee to make choice out of them, of what is moſt pleaſant to thy Taſt, and of moſt wholſom and pleaſant Nouriſhment; I have alſo made great variety of Trees, bearing Fruit both for Food and Phyſick, thoſe too capable of being meliorated and improved by Tranſplantation, Stercoration, Inſition, Pruning, Watering, and other Arts and Devices. Till and manure thy Fields, ſow them with thy Seeds, extirpate noxious and unprofitable Herbs, guard them from the invaſions and ſpoil of Beaſts, clear and fence in thy Meadows and Paſtures; dreſs and prune thy Vines, and ſo rank and diſpoſe them as is moſt ſutable to the Climate; Plant thee Orchards, with

all

all ſorts of Fruit-Trees in ſuch order as may be moſt beautiful to the Eye, and moſt comprehenſive of Plants; Gardens for culinary Herbs, and all kinds of Salletting; for delectable Flowers, to gratifie the Eye with their agreeable Colors and Figures, and thy ſcent with their fragrant Odors; for odoriferous and ever-green Shrubs and *Suffrutices*; for exotick and medicinal Plants of all ſorts, and diſpoſe them in that comly order, as may be both pleaſant to behold, and commodious for Acceſs. I have furniſhed thee with all Materials for building, as Stone, and Timber, and Slate, and Lime, and Clay, and Earth whereof to make Bricks and Tiles. Deck and beſpangle the Country with Houſes and Villages convenient for thy Habitation, provided with Out-houſes and Stables for the harbouring and ſhelter of thy Cattle, with Barns and Granaries for the reception, and cuſtody, and ſtoring up thy Corn and Fruits. I have made thee a ſociable Creature, ζῶον πολιτικὸν, for the improvement of thy Underſtanding by Conference, and communication of Obſervations and Experiments; for mutual help, aſſiſtance and defence; build thee large Towns and Cities with ſtreight and well paved Streets, and elegant rows of Houſes, adorned with magnificent Tem-

ples for my Honour and Worship, with beautiful Palaces for thy Princes and Grandees, with stately Halls for publick meetings of the Citizens and their several Companies, and the Sessions of the Courts of Judicature, besides publick Portico's and Aquæducts. I have implanted in thy Nature a desire of seeing strange and foreign and finding out unknown Countries, for the improvement and advancement of thy Knowledge in *Geography*, by observing the Bays, and Creeks, and Havens, and Promontories, the outlets of Rivers, the situations of the maritime Towns and Cities, the Longitude and Latitude, *&c.* of those Places: In *Politicks*, by noting their Government, their Manners, Laws and Customs, their Diet and Medicine, their Trades and Manufactures, their Houses and Buildings, their Exercises and Sports *&c.* In *Physiology* or Natural History, by searching out their natural Rarities, the productions both of Land and Water, what *Species* of Animals, Plants and Minerals, of Fruits and Drogues are to be found there, what Commodities for Bartering and Permutation, whereby thou maist be enabled to make large Additions to Natural History, to advance those other Sciences, and to benefit and enrich thy Country by encrease of its

Trade

Trade and Merchandiſe: I have given thee Timber and Iron to build thee Huls of Ships, tall Trees for Maſts, Flax and Hemp for Sails, Cables, and Cordage for Rigging. I have armed thee with Courage and Hardineſs to attempt the Seas, and traverſe the ſpacious Plains of that liquid Element; I have aſſiſted thee with a Compaſs, to direct thy Courſe when thou ſhalt be out of all Ken of Land, and have nothing in view but Sky and Water. Go thither for the Purpoſes before mentioned, and bring home what may be uſeful and beneficial to thy Country in general, or thy Self in particular.

I perſwade my ſelf, that the bountiful and gracious Author of Mans Being and Faculties, and all things elſe, delights in the Beauty of his Creation, and is well pleaſed with the Induſtry of Man in adorning the Earth with beautiful Cities and Caſtles, with pleaſant Villages and Country Houſes, with regular Gardens and Orchards and Plantations of all ſorts of Shrubs, and Herbs, and Fruits, for Meat, Medicine or moderate Delight, with ſhady Woods and Groves, and Walks ſet with rows of elegant Trees; *with Paſtures clothed with Flocks, and Valleys covered over with Corn*, and Meadows burthened with Graſs, and whatever elſe

differenceth a civil and well-cultivated Region from a barren and desolate Wilderness.

If a Country thus planted and adorned, thus polished and civilized, thus improved to the height by all manner of Culture for the Support and Sustenance, and convenient Entertainment of innumerable multitudes of People, be not to be preferred before a Barbarous and Inhospitable *Scythia*, without Houses, without Plantations, without Corn-fields or Vineyards, where the roving *Hords* of the savage and truculent Inhabitants, transfer themselves from place to place in Wagons, as they can find Pasture and Forage for their Cattle, and live upon Milk and Flesh roasted in the Sun at the Pomels of their Saddles; or a rude and unpolished *America*, peopled with slothful and naked *Indians*, instead of well-built Houses, living in pitiful Hutts and Cabans, made of Poles set endways; then surely the brute Beasts Condition and manner of Living, to which, what we have mention'd doth nearly approach, is to be esteemed better than Mans, and Wit and Reason was in vain bestowed on him.

Lastly, I might draw an Argument of the admirable Art and Skill of the Creator and Composer of them from the incredible Smal-

neſs of ſome of thoſe natural and enlivened Machines, the Bodies of Animals.

Any work of Art of extraordinary Fineneſs and Subtlety, be it but a ſmall Engine or Movement, or a curious carved or turned work of Ivory or Metals, ſuch as thoſe Cups turned of Ivory by *Oſwaldus Nerlinger* of *Suevia*, mentioned by *Joan. Faber* in his Expoſitions of *Recchus* his *Mexican* Animals, which all had the perfect form of Cups, and were Gilt with a Golden Border about the Brim, of that wonderful ſmalneſs, that *Faber* himſelf put a Thouſand of them into an excavated Pepper-corn, and when he was weary of the work, and yet had not filled the Veſſel, his Friend *John Carolus Schad*, that ſhewed them him, put in Four Hundred more. Any ſuch Work, I ſay, is beheld with much admiration, and purchaſed at a great Rate, and treaſured up as a ſingular Rarity in the *Muſeums* and Cabinets of the curious, and as ſuch is one of the firſt things ſhew'd to *Travellers* and *Strangers*. But what are theſe for their fineneſs and parvity (for which alone and their Figure they are conſiderable) to thoſe minute Machines endued with life and motion, I mean the Bodies of thoſe *Animalcula* not long ſince diſcovered in *Pepper-water* by Mr. *Lewenhoek* of *Delft* in *Holland*, (whoſe Obſervations

were confirmed and improved by our Learned and Worthy Country-man Mr. *Robert Hook*,) who tells us, that ſome of his Friends (whoſe Teſtimonials he deſired) did affirm, that they had ſeen 10000, others 30000, others 45000 little living Creatures in a quantity of Water no bigger than a grain of *Millet*. And yet he made it his requeſt to them, that they would only juſtifie (that they might be within compaſs) half the number that they believed each of them ſaw in the Water. From the greateſt of theſe numbers he infers, that there will be 8280000 of theſe living Creatures ſeen in one drop of Water; which number (ſaith he) I can with Truth affirm I have diſcerned. This (proceeds he) doth exceed belief. But I do affirm, if a larger Grain of Sand were broken into 8000000, of equal Parts, one of theſe would not exceed the bigneſs of one of thoſe Creatures. Mr. *Hook* tells us, that after he had diſcovered vaſt multitudes of thoſe exceeding ſmall Creatures which Mr. *Lewenhoeck* had deſcribed, upon making uſe of other Lights and Glaſſes, he not only magnified thoſe he had diſcovered to a very great bigneſs, but diſcovered many other ſorts very much ſmaller than them he firſt ſaw, and ſome of them ſo exceeding ſmall, that Millions of Millions might be

contained

contained in one drop of Water. If *Pliny*, conſidering ſuch Inſects as were known to him, and thoſe were none but what were viſible to the naked Eye, was moved to cry out, That the artifice of Nature was no where more conſpicuous than in theſe; and again, *In his tam parvis atque tam nullis quæ ratio, quanta vis, quàm inextricabilis perfectio?* and again, *Rerum natura nuſquam magis quàm in minimis tota eſt. Hiſt. Nat.* l. 11. c. 1. What would he have ſaid if he had ſeen Animals of ſo ſtupendous ſmalneſs as I have mentioned? how would he have been rapt into an extaſie of Aſtoniſhment and Admiration?

Again, if conſidering the Body of a Gnat, (which by his own confeſſion is none of the leaſt of Inſects) he could make ſo many admiring Queries, *Where hath Nature diſpoſed ſo many Senſes in a Gnat? Ubi viſum prætendit? ubi guſtatum applicavit? ubi odoratum inſeruit? ubi verò truculentam illam & portione maximam vocem ingeneravit? quâ ſubtilitate pennas adnexuit? prælongavit pedum crura? diſpoſuit jejunam caveam uti alvum? avidam ſanguinis & potiſſimum humani ſitim accendit? telum vero perfodiendo tergori quo ſpiculavit ingenio? atque ut in capaci, cùm cerni non poſſit exilitas, ità reciproca geminavit arte, ut fodiendo acuminatum pariter ſorbendoque fiſtuloſum eſſet.*

Which

Which Words should I translate would lose of their *emphasis* and elegancy. If, I say, he could make such Queries about the Members of a Gnat. What may we make? and what would he in all likelyhood have made had he seen these incredible small living Creatures? How would he have admired the immense subtilty (as he phrases it) of their Parts? for to use Mr. *Hook*'s Words in his *Microscopium p.* 103. If these Creatures be so exceeding small, what must we think of their Muscles and other Parts? Certain it is that the Mechanism by which Nature performs the Muscular Motion is exceedingly small and curious; and to the performance of every Muscular Motion, in greater Animals at least, there are not fewer distinct parts concerned than many Millions of Millions, and these visible through a Microscope.

Use. Let us then consider the Works of God, and observe the Operations of his Hands: Let us take notice of and admire his infinite Wisdom and Goodness in the Formation of them: No Creature in this Sublunary World is capable of so doing beside Man; and yet we are deficient herein: We content our selves with the knowledge of the Tongues, and a little skill in Philology, or History perhaps and Antiquity,

and

and neglect that which to me ſeems more material, I mean Natural Hiſtory and the Works of the Creation: I do not diſcommend or derogate from thoſe other Studies: I ſhould betray mine own Ignorance and Weakneſs ſhould I do ſo; I only wiſh they might not altogether juſtle out and exclude this. I wiſh that this might be brought in Faſhion among us; I wiſh men would be ſo equal and civil, as not to diſparage, deride and vilifie thoſe Studies which themſelves skill not of, or are not converſant in; no Knowledge can be more pleaſant than this, none that doth ſo ſatisfie and feed the Soul; in compariſon whereto that of Words and Phraſes ſeems to me inſipid and jejune. That Learning (ſaith a wiſe and obſervant Prelate) which conſiſts only in the form and pedagogy of Arts, or the critical notions upon Words and Phraſes, hath in it this intrinſical Imperfection, that it is only ſo far to be eſteemed as it conduceth to the knowledg of Things, being in it ſelf but a kind of Pedantry, apt to infect a man with ſuch odd Humors of Pride, and Affectation, and Curioſity, as will render him unfit for any great Employment. Words being but the Images of Matter, to be wholly given up to the Study of theſe. What is it but *Pygmalions*

malions Phrenzy, to fall in Love with a Picture or Image. As for *Oratory* which is the beſt skill about Words, that hath by ſome Wiſe men been eſteemed but a voluptuary Art, like to Cookery, which ſpoils wholſome Meats and helps unwholſome, by the variety of Sawces ſerving more to the Pleaſure of Taſt, than the Health of the Body.

It may be (for ought I know, and as ſome Divines have thought) part of our buſineſs and employment in Eternity to contemplate the Works of God, and give him the Glory of his Wiſdom, Power and Goodneſs manifeſted in the Creation of them. I am ſure it is part of the buſineſs of a Sabbath-day, and the Sabbath is a Type of that eternal Reſt; for the Sabbath ſeems to have been firſt inſtituted for a commemoration of the Works of the Creation, from which God is ſaid to have reſted upon the Seventh Day.

Let it not ſuffice us to be Book-learned, to read what others have written, and to take upon truſt more Falſhood than Truth: but let us our ſelves examine things as we have opportunity, and converſe with Nature as well as Books. Let us endeavour to promote and increaſe this Knowledge, and make new Diſcoveries, not ſo much diſtruſting our own Parts, or deſpairing of our own Abilities, as to think that our Induſtry

duſtry can add nothing to the Inventions of our Anceſtors, or correct any of their miſtakes. Let us not think that the bounds of Science are fixed like *Hercules* his Pillars, and inſcribed with a *Ne plus ultra*. Let us not think we have done when we have learnt what they have delivered to us. The Treaſures of Nature are inexhauſtible. Here is Employment enough for the vaſteſt Parts, the moſt indefatigable Induſtries, the faireſt Opportunities, the moſt prolix and undiſturbed Vacancies. Much might be done would we but endeavour, and nothing is inſuperable to pains and patience. I know that a new Study at firſt, ſeems very Vaſt, Intricate and Difficult; but after a little Reſolution and Progreſs, after a man becomes a little acquainted, as I may ſo ſay, with it, his Underſtanding is wonderfully cleared up and enlarged, the difficulties vaniſh, and the thing grows eaſie and familiar. And for our Encouragement in this Study, obſerve what the Pſalmiſt ſaith, Pſal. 111. 2. *The works of the Lord are great, ſought out of all them that have pleaſure therein.* Which though it be principally ſpoken of the Works of Providence, yet may as well be verified of the Works of Creation. I am ſorry to ſee ſo little Account made of real *Experimental Philo-*

ſophy

ſophy in this Univerſity, and that thoſe ingenious Sciences of the *Mathematicks*, are ſo much neglected by us: and therefore do earneſtly exhort thoſe that are young, eſpecially Gentlemen, to ſet upon theſe Studies, and take ſome pains in them. They may poſſibly invent ſomething of eminent Uſe and Advantage to the World; and one ſuch Diſcovery would abundantly compenſate the Expence and Travel of one mans whole Life. However, it is enough to maintain and continue what is already invented: neither do I ſee what more ingenious and manly Employment they can purſue, tending more to the Satisfaction of their own Minds, and the Illuſtration of the Glory of God. For he is wonderful in all his Works.

But I would not have any man croſs his natural Genius or Inclinations, or undertake ſuch methods of Study, as his Parts are not fitted to, or not ſerve thoſe Ends to which his Friends upon mature Deliberation have deſigned him; but thoſe who do abound with leiſure, or who have a natural Propenſion and *Genius* inclining them thereto, or thoſe who by reaſon of the Strength and Greatneſs of their Parts, are able to compaſs and comprehend the whole Latitude of Learning.

Neither

Neither yet need thoſe who are deſigned to Divinity it ſelf, fear to look into theſe Studies, or think they will engroſs their whole time, and that no conſiderable Progreſs can be made therein, unleſs men lay aſide and neglect their ordinary Callings, and neceſſary Employments. No ſuch matter. Our Life is long enough, and we might find time enough, did we husband it well: *Vitam non accepimus brevem ſed fecimus, nec inopes ejus, ſed prodigi ſumus*, as *Seneca* ſaith. And did but young men fill up that time with theſe Studies, which lies upon their hands, which they are incumbred with, and troubled how to paſs away, much might be done even ſo. I do not ſee but the Study of true Phyſiology, may be juſtly accounted a proper *προπαιδεία*, or Preparative to Divinity. But to leave that, It is a generally received Opinion, that all this viſible world was created for Man; that Man is the end of the Creation, as if there were no other end of any Creature, but ſome way or other to be ſerviceable to man. This Opinion is as old as *Tully*, for ſaith he, in his Second Book, *De Nat. Deorum. Principio ipſe Mundus Deorum hominumq; causâ factus eſt; quæq; in eo ſunt omnia ea parata ad fructum hominum & inventa ſunt.* But though this be vulgarly received, yet Wiſe Men now a-

days

days think otherwise. Dr. * *More* affirms, * *Antid. Atheism.* l. 2. c. 11.
'That Creatures are made to enjoy themselves, as well as to serve us, and that 'it's a gross piece of Ignorance and Rusticity to think otherwise. And in another place, 'This comes only out of Pride and 'Ignorance or a haughty Presumption, because we are encouraged to believe, that 'in some sence, all things are made for Man, 'therefore to think that they are not at 'all made for themselves. But he that pronounceth this, is ignorant of the Nature 'of Man, and the Knowledge of Things. 'For if a good Man be merciful to his 'Beast, then surely, a good God is Bountiful and Benign, and takes pleasure that 'all his Creatures enjoy themselves that 'have Life and Sense, and are capable of 'Enjoyment. For my part, I cannot believe that all the things in the world were so made for Man, that they have no other use.

For it is highly absurd and unreasonable, to think that Bodies of such vast magnitude as the fixt Stars, were only made to twinkle to us; nay, a multitude of them there are, that do not so much as twinkle, being either by reason of their Distance or of their Smalness, altogether invisible to the naked Eye, and only discoverable by a Telescope, and it is likely perfecter Telescopes than

than we yet have, may bring to light many more; and who knows, how many may lie out of the ken of the beſt Teleſcope that can poſſibly be made. And I believe there are many Species in Nature, which were never yet taken notice of by Man, and conſequently of no Uſe to him, which yet we are not to think were Created in vain; but it's likely (as the Doctor ſaith) to partake of the overflowing Goodneſs of the Creator, and enjoy their own beings. But though in this ſence it be not true, that all things were made for Man; yet thus far it is, that all the Creatures in the world may be ſome way or other uſeful to us, at leaſt to exerciſe our Wits and Underſtandings, in conſidering and contemplating of them, and ſo afford us Subject of Admiring and Glorifying their and our Maker. Seeing then, we do believe and aſſert that all things were in ſome ſence made for us, we are thereby obliged to make uſe of them for thoſe purpoſes for which they ſerve us, elſe we fruſtrate this End of their Creation. Now ſome of them ſerve only to exerciſe our Minds: many others there be, which might probably ſerve us to good purpoſe, whoſe Uſes are not diſcovered, nor are they ever like to be, without Pains and Induſtry. True it is, many of the greateſt Inventions

have been accidentally ſtumbled upon, but not by men ſupine and careleſs, but buſie and inquiſitive. Some Reproach methinks it is to Learned Men, that there ſhould be ſo many Animals ſtill in the World, whoſe outward ſhape is not yet taken notice of, or deſcribed, much leſs their way of Generation, Food, Manners, Uſes, obſerved. If Man ought to reflect upon his Creator the Glory of all his Works, then ought he to take notice of them all, and not to think any thing unworthy of his Cognizance. And truly the Wiſdom, Art and Power of Almighty God, ſhines forth as viſibly in the Structure of the Body of the minuteſt Inſect, as in that of a *Horſe* or *Elephant*: Therefore God is ſaid to be, *maximus in minimis*. We men, eſteeming it a more difficult Matter, and of greater Art and Curioſity to frame a ſmall Watch, than a large Clock: And no man blames him who ſpent his whole time in the conſideration of the Nature and Works of a Bee, or thinks his ſubject was too narrow. Let us not then eſteem any thing contemptible or inconſiderable, or below our notice-taking; for this is to derogate from the Wiſdom and Art of the Creator, and to confeſs our ſelves unworthy of thoſe Endowments of Knowledge and Underſtanding which he hath beſtowed on us. Do we praiſe *Dædalus*,

and

and *Architas*, and *Hero*, and *Callicrates*, and *Albertus Magnus*, and many others which I might mention, for their cunning in inventing, and dexterity in framing and compoſing a few dead Engines or Movements: and ſhall we not admire and magnifie the Great δημιουργὸς κόσμου, Former of the World, who hath made ſo many, yea I may ſay innumerable, rare Pieces, and thoſe too not dead ones, ſuch as ceaſe preſently to move ſo ſoon as the Spring is down, but all living, and themſelves performing their own Motions, and thoſe ſo intricate, and various, and requiring ſuch a multitude of Parts and ſubordinate Machins, that it is incomprehenſible, what Art, and Skill, and Induſtry, muſt be employed in the Framing of one of them.

But it may be objected, That God Almighty was not ſo ſelfiſh and deſirous of Glory, as to make the World and all the Creatures therein, only for his own Honour, and to be Praiſed by Man. To aſſert this, were in *Des Cartes* his Opinion, an abſurd and Childiſh thing, and a reſembling of God to proud Man. It is more worthy the Deity to attribute the Creation of the World to the exundation and overflowing of his Tranſcendent and Infinite Goodneſs, which is of its own Nature and in the very notion of it moſt Free, Diffuſive, and Communicative.

To this I ſhall anſwer in two Words. Firſt, The Teſtimony of Scripture makes God in all his Actions to Intend and Deſign his own Glory mainly. *Prov.* 16. 4. *God made all things for himſelf.* How, for Himſelf? He had no Need of them: he hath no Uſe of them. No, he made them for the manifeſtation of his Power, Wiſdom, and Goodneſs, and that he might receive from the Creatures that were able to take notice thereof his Tribute of Praiſe. Pſal. 50. 14. *Offer unto God thanksgiving.* and in the next verſe, *I will deliver thee, and thou ſhalt glorifie me.* And again in the laſt Verſe, *Whoſo offereth praiſe glorifieth me.* So Praiſe is called a Sacrifice, and *the Calves of the Lips*, Hoſea 14. 2. Eſay 42. 8. *I am the Lord, that is my name, and my glory will I not give to another.* Eſay 48. 11. *And I will not give my glory to another.* And to me it ſeems, that where the Heavens and Earth, and Sun, and Moon, and Stars, and all other Creatures are called upon to Praiſe the Lord; the meaning and intention is, to invite and ſtir up Man to take notice of all thoſe Creatures, and to Admire and Praiſe the Power, Wiſdom and Goodneſs of God manifeſted in the Creation and Deſignations of them. Secondly, It is moſt reaſonable that God Almighty ſhould intend his own Glory.

Glory. For he being Infinite in all Excellencies and Perfections, and Independent upon any other Being; nothing can be ſaid or thought of him too great, and which he may not juſtly challenge as his Due; nay, He cannot think too highly of Himſelf, his other Attributes being adequate to his Underſtanding; ſo that, though his Underſtanding be Infinite, yet he underſtands no more than his Power can effect, becauſe that is Infinite alſo. And therefore it is fit and reaſonable, that he ſhould own and accept the Creatures Acknowledgments and Celebrations of thoſe Vertues and Perfections, which he hath not received of any other, but poſſeſſeth Eternally and Originally of himſelf. And indeed, (with reverence be it ſpoken,) what elſe can we imagine the ever Bleſſed Deity to delight and take complacency in for ever, but his own Infinite Excellencies and Perfections, and the Manifeſtations and Effects of them, the Works of the Creation, and the Sacrifices of Praiſe and Thanks offered up by ſuch of his Creatures as are capable of conſidering thoſe Works, and diſcerning the Traces and Footſteps of his Power and Wiſdom appearing in the Formation of them, and moreover, whoſe bounden Duty it is ſo to do. The reaſon why Man ought not to ad-

mire himself, or seek his own Glory, is, because he is a dependent Creature, and hath nothing but what he hath received, and not only dependent, but imperfect; yea, weak and impotent. And yet do I not take Humility in man to consist in disowning or denying any Gift or Ability that is in him, but in a just valuation of such Gifts and Endowments, yet rather thinking too meanly than too highly of them; because Humane Nature is so apt to err in running into the other extreme, to flatter it self, and to accept those Praises that are not due to it; Pride being an elation of Spirit upon false Grounds, or a desire or acceptance of undue Honour. Otherwise, I do not see why a man may not admit and accept the Testimonies of others concerning any Perfection, Accomplishment or Skill that he is really possessed of: yet can he not think himself to deserve any great Praise or Honour for it, because both the Power and the Habit are the Gift of God: And considering that one Vertue is counter-balanced by many Vices; and one Skill or Perfection, with much Ignorance and Infirmity.

I proceed now to select some particular Pieces of the Creation, and to consider them more distinctly. They shall be only

two.

two. 1. The whole Body of the Earth. 2. The Body of Man.

First the Body of the Earth, and therein I shall take notice of 1. Its Figure. 2. Its Motion. 3. The Constitution of its parts.

By Earth I here understand not the Dry Land, or the Earth contradistinguished to Water, or the Earth considered as an Element: but the whole *Terraqueous* Globe composed of Earth and Water.

1. For the *Figure*, I could easily demonstrate it to be Spherical. That the Water, which by reason of its fluidity should, one would think, compose it self to a Level, yet doth not so, but hath a Gibbose *Superficies*, may to the Eye be demonstrated upon the Sea. For when two Ships sailing contrary ways lose the sight one of another: first the Keel and Hull disappear, afterward the Sails, and if when upon Deck you have perfectly lost sight of all, you get up the top of the Main-mast you may descry it again. Now what should take away the sight of these Ships from each other but the gibbosity of the interjacent Water? The roundness of the Earth from North to South is demonstrated from the appearance of Northern Stars above the Horizon, and loss of the Southern to them that travel Northward; and on the contrary the loss of the Northern and

appearance of the Southern to them that travel Southward. For were the Earth a Plain we should see exactly the same Stars wherever we were placed on that Plain. The roundness from East to West is demonstrated from *Eclipses* of either of the great *Luminaries*. For why the same *Eclipse*, suppose of the *Sun*, which is seen to them that live more Easterly, when the Sun is elevated 6 degrees above the Horizon, should be seen to them that live one degree more Westernly when the Sun is but five degrees above the Horizon, and so lower and lower proportionably to them that live more and more Westernly, till at last it appear not at all, no accompt can be given but the globosity of the Earth. For were the Earth a perfect Plain, the Sun would appear Eclipsed to all that live upon that Plain, if not exactly in the same Elevation, yet pretty near it; but to be sure it would never appear to some, the Sun being Elevated high above the Horizon; and not at all to others. It being clear then that the Figure of the Earth is Spherical, let us consider the Conveniences of this Figure.

1. No Figure is so capacious as this, and consequently whose parts are so well compacted and united, and lie so near one to another for mutual strength. Now the Earth, which

which is the basis of all Animals, and as some think of the whole Creation, ought to be firm, and stable, and solid, and as much as is possible secured from all Ruins and Concussions.

2. This Figure is most consonant and agreeable to the natural *Nutus* or tendency of all heavy Bodies. Now the Earth being such a one, and all its parts having an equal propension or connivency to the Center, they must needs be in greatest rest, and most immoveable when they are all equidistant from it. Whereas were it an Angular Body, all the Angles would be vast and steep Mountains, bearing a considerable proportion to the whole bulk, and therefore those parts being extremely more remote from the Center, than those about the middle of the Plains, would consequently press very strongly thitherward; and unless the Earth were made of Adamant or Marble, in time the other parts would give way, till all were levelled.

3. Were the Earth an angular Body and not round, all the whole Earth would be nothing else but vast Mountains, and so incommodious for Animals to live upon. For the middle point of every side would be nearer the Center than any other, and consequently from that point which way soever one travelled would be up Hill, the tend-

tendency of all heavy Bodies being perpendicularly to the Center. Beſides how much this would obſtruct Commerce is eaſily ſeen. For not only the declivity of all places would render them very difficult to be travelled over, but likewiſe the midſt of every ſide being loweſt and neareſt the Center, if there were any Rain or any Rivers, muſt needs be filled with a Lake of Water, there being no way to diſcharge it, and poſſibly the Water would riſe ſo high as to overflow the whole *Latus*. But ſurely there would be much more danger of the Inundation of whole Countries than now there is: all the Waters falling upon the Earth, by reaſon of its declivity every way, eaſily deſcending down to the common Receptacle the Sea. And theſe Lakes of Water being far diſtant one from another, there could be no Commerce between far remote Countries but by Land.

4. A Spherical Figure is moſt commodious for *dinetical* motion or revolution upon its own *Axis*. For in that neither can the Medium at all reſiſt the motion of the Body, becauſe it ſtands not in its way, no part coming into any ſpace but what the precedent left, neither doth one part of the Superficies move faſter than another: whereas were it Angular, the parts about the Angles would find ſtrong reſiſtance from the Air,

Air, and thoſe parts alſo about the Angles would move much faſter than thoſe about the middle of the Plains, being remoter from the center than they. It remains therefore that this Figure is the moſt commodious for Motion.

Here I cannot but take notice of the folly and ſtupidity of the *Epicureans*, who fancied the Earth to be flat and contiguous to the Heavens on all ſides, and that it deſcended a great way with long Roots; and that the Sun was new made every Morning, and not much bigger than it ſeems to the Eye, and of a flat Figure, and many other ſuch groſs Abſurdities as Children among us would be aſhamed of.

Secondly, I come now to ſpeak of the *Motion* of the *Earth*. That the *Earth* (ſpeaking according to Philoſophical accurateneſs) doth move both upon its own Poles, and in the *Ecliptick*, is now the received Opinion of the moſt learned and skilful *Mathematicians*. To prove the diurnal Motion of it upon its Poles, I need produce no other Arguments than, Firſt, The vaſt diſproportion in reſpect of Magnitude that is between the Earth and the Heavens, and the great unlikelyhood, that ſuch an infinite number of vaſt Bodies ſhould move about ſo inconſiderable a ſpot as the Earth, which in compariſon with them by

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the concurrent suffrages of Mathematicians of both perswasions, is a mere point, that is, next to nothing. Secondly, The immense and incredible Celerity of the Motion of the Heavenly Bodies in the ancient *Hypothesis*; of its Annual Motion in the Ecliptick, the Stations and Retrogradations of the superior Planets are a convincing Argument, there being a clear and facile Account thereof to be given from the mere Motion of the Earth in the *Ecliptick*; whereas in the Old *Hypothesis* no account can be given thereof, but by the unreasonable Fiction of *Epicycles* and contrary Motions; add hereto the great unlikelyhood of such an enormous *Epicycle* as *Venus* must describe about the Sun, not under the Sun as the old Astronomers fancied; So that whosoever doth clearly understand both *Hypotheses*, cannot, I perswade my self, adhere to the Old and reject the New, without doing some violence to his Faculties.

Against this Opinion lie two Objections, First, That it is contrary to Sense, and the common Opinion and Belief of Mankind. Secondly, That it seemeth contrary to some Expressions in *Scripture*. To the first I answer, that our Senses are sometimes mistaken, and what appears to them is not always

always in reality ſo as it appears. For Example, The Sun or Moon appear no bigger at moſt, than a Cart-wheel, and of a flat figure. The Earth ſeems to be plain; the Heavens to cover it like a Canopy, and to be contiguous to it round about: A Fire-brand nimbly moved round, appears like a circle of Fire; and to give a parallel Inſtance, a Boat lying ſtill at Anchor in a River to him that ſails or rows by it, ſeems to move apace: and when the Clouds paſs nimbly under the Moon, the Moon it ſelf ſeems to move the contrary way. And there have been whole Books written in Confutation of vulgar Errours. Secondly, As to the *Scripture*, when ſpeaking of theſe things it accommodates it ſelf to the common and received Opinions, and employs the uſual Phraſes and Forms of Speech, (as all Wiſe Men alſo do, though in ſtrictneſs, they be of a different or contrary Opinion,) without intention of delivering any thing Doctrinally concerning theſe Points, or confuting the contrary: And yet by thoſe that maintain the Opinion of the Earths motion there might a convenient Interpretation be given of ſuch places as ſeem to contradict it. Howbeit, becauſe ſome pious Perſons may be offended at ſuch an Opinion, as ſavouring of Novelty, thinking it inconſiſtent

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with Divine Revelation, I ſhall not poſitively aſſert it, only propoſe it as an *Hypotheſis* not altogether improbable. Suppoſing then, that the Earth doth move, both upon its own Poles, and in the Ecliptick about the Sun, I ſhall ſhew how admirably its Situation and Motion are contrived for the conveniency of Man and other Animals: which I cannot do more fully and clearly than Dr. *More* hath already done in his *Antidote againſt Atheiſm*, whoſe Words therefore I ſhall borrow.

Firſt, Speaking of the *Paralleliſm* of the *Axis* of the *Earth* he ſaith, I demand whether it be better to have the *Axis* of the *Earth* ſteady and perpetually parallel to it ſelf, or to have it careleſly tumble this way and that way as it happens, or at leaſt very variouſly and intricately: And you cannot but anſwer me, it is better to have it ſteady and parallel. For in this lies the neceſſary Foundation of the Art of Navigation and Dialling. For that ſteady Stream of Particles, which is ſuppoſed to keep the *Axis* of the *Earth* parallel to its ſelf, affords the Mariner both his *Cynoſura* and his Compaſs. The Load-ſtone and the Load-ſtar depend both upon this. The *Load-ſtone* as I could demonſtrate, were it not too great a digreſſion; and the *Load-ſtar*, becauſe that which keeps the *Axis* parallel to its ſelf, makes each of the

Poles

Poles conſtantly reſpect ſuch a point in the Heavens; as for Example, the *North-pole* to point almoſt directly to that which we call the *Pole-ſtar*. And beſides, *Dialling* could not be at all without this ſteadineſs of the *Axis*. But both theſe Arts are pleaſant, and one eſpecially of mighty Importance to Mankind. For thus there is an orderly meaſuring of our time for Affairs at home, and an opportunity of Traffick abroad with the moſt remote Nations of the World, and ſo there is a mutual Supply of the ſeveral Commodities of all Countries, beſides the enlarging our Underſtandings by ſo ample Experience we get both of men and things. Wherefore if we were rationally to conſult, whether the *Axis* of the *Earth* were better be held ſteady and parallel to it ſelf, or left at random, we would conclude it ought to be ſteady, and ſo we find it *de Facto*, though the Earth move floating in the liquid Heavens. So that appealing to our own Faculties we are to affirm, that the conſtant Direction of the *Axis* of the Earth was Eſtabliſhed by a principle of Wiſdom and Counſel.

Again, there being ſeveral poſtures of this ſteady Direction of the *Axis* of the Earth. *viz.* Either perpendicular to a Plain, going through the Center of the *Sun*, or coinci-

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dent, or inclining, I demand which of all these Reason and Knowledge would make choice of. Not of a perpendicular Posture. For so both the pleasant Variety and great Convenience of Summer and Winter, Spring and Autumn would be lost, and for want of Accession of the Sun, these Parts of the Earth, which now bring forth Fruits, and are Habitable, would be in an incapacity of ever bringing forth any, and consequently could entertain no Inhabitants, and those Parts that the full heat of the Sun could reach, he plying them always alike without any annual Recession or Intermission, would at last grow tired or exhausted, or be wholly dried up and want moisture, the Sun dissipating and casting off the Clouds Northwards and Southwards. Besides, we observe that an orderly vicissitude of things, doth much more gratifie the contemplative Property in Man.

And now in the second place, neither would Reason make choice of a coincident Position. For if the *Axis* thus lay in a plain that goeth through the Center of the *Sun*, the *Ecliptick* would like a *Colure* or one of the *Meridians*, pass through the *Poles* of the Earth, which would put the Inhabitants of the World, into a pitiful condition. For they that escape best in

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the *Temperate Zone* would be accloyed with long Nights very tedious, no leſs than Forty Days, and thoſe that now never have their Night above Twenty Four Hours, as *Frieſland Iſland*, the furtheſt parts of *Ruſſia* and *Norway* would be deprived of the Sun, above a Hundred and Thirty Days together. Our ſelves in *England* and the reſt of the ſame Clime would be cloſed up in darkneſs no leſs than a Hundred or Eighty Days: and ſo proportionably of the reſt both in and out of the *Temperate Zones*. And as for Summer and Winter, though thoſe Viciſſitudes would be, yet it could not but cauſe raging Diſeaſes, to have the Sun ſtay ſo long, deſcribing his little Circles ſo near the *Poles*, and lying ſo hot on the Inhabitants, that had been in ſo long extremity of Darkneſs and Cold before.

It remains therefore, that the poſture of the *Axis* of the Earth be inclining not perpendicular nor coincident to the fore-mentioned Plain. And verily, it is not only inclining, but in ſo fit a proportion, that there can be no fitter imagined to make it to the utmoſt capacity as well pleaſant as habitable. For though the courſe of the Sun be curbed between the *Tropicks*, yet are not thoſe parts directly ſubject to his perpendicular Beams, either Unhabitable or ex-

tremely Hot, as the Ancients fanſied: By the Teſtimony of Travellers, and particularly Sir *Walter Ralegh*, the parts under and near the Line, being as Fruitful and Pleaſant, and fit to make a Paradiſe of, as any in the World. And that they are as ſuitable to the nature of Man, and as convenient to live in, appears from the Longævity of the Natives; as for Inſtance, the *Æthiopes* called by the Ancients μακρόβιοι, but eſpecially the *Braſilians* in *America*, the ordinary Term of whoſe Life is a Hundred Years, as is ſet down by *Piſo* a Learned Phyſitian of *Holland*, who travelled thither on purpoſe to augment natural Knowledge, but eſpecially what related to Phyſick. And reaſonable it is, that this ſhould be ſo, for neither doth the Sun lie long upon them, their Day being but Twelve Hours, and their Night as long, to cool and refreſh them; and beſides, they have frequent Showers, and conſtant Breezes or freſh Gales of Wind from the Eaſt. Seeing then, this beſt poſture which our Reaſon could make choice of, we ſee really Eſtabliſhed in Nature, we cannot but acknowledge it to be the iſſue of Wiſdom, Counſel and Providence. Moreover, a further Argument to evince this is, That though it cannot but be acknowledged, that if the *Axis*

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of the Earth were perpendicular to the plain of the Ecliptick, her motion would be more eaſie and natural, yet notwithſtanding for the Conveniencies forementioned, we ſee it is made in an inclining poſture.

If any man ſhall object and ſay, It would be more convenient for the Inhabitants of the Earth, if the Tropicks ſtood at a greater diſtance, and the Sun moved further Northward and Southward, for ſo the North and South parts would be relieved, and not expoſed to ſo extreme cold, and thereby rendred unhabitable as now they are.

To this I anſwer, That this would be more inconvenient to the Inhabitants of the *Earth* in general, and yet would afford the *North* and *South* parts but little more comfort. For then as much as the diſtances between the *Tropicks* were enlarg'd, ſo much would alſo the *Artick* and *Antartick* Circles be enlarg'd too; and ſo we here in *England*, and ſo on Northerly ſhould not have that grateful and uſeful Succeſſion of Day and Night, but proportionably to the Suns coming towards us, ſo would our days be of more than Twenty Four Hours length, and according to his receſs in Winter our Nights proportionable; which how great an inconvenience it would be, is eaſily ſeen.

Whereas now the whole Latitude of Earth, which hath at any time above Twenty Four Hours Day, and Twenty Four Hours Night, is little and inconſiderable in compariſon of the whole bulk, as lying near the *Poles*. And yet neither is that part altogether unuſeful, for in the Waters there live Fiſhes, which otherwhere are not obvious, ſo we know the chief *Whale-fiſhing* is in *Greenland*: And on the Land, *Bears*, and *Foxes*, and *Deer*, in the moſt Northerly Country, that was ever yet touched, and doubtleſs if we ſhall diſcover further to the very *North-pole*, we ſhall find all that Tract not to be vain, uſeleſs or unoccupied.

Thirdly, The Third and Laſt thing I propoſed, was the Conſtitution and Conſiſtency of the parts of the Earth. And firſt, Admirable it is that the Waters ſhould be gathered together into ſuch great *Conceptacula*, and the dry Land appear, and though we had not been aſſured thereof by Divine Revelation, we could not in Reaſon, but have thought ſuch a Diviſion and Separation, to have been the Work of Omnipotency and Infinite Wiſdom and Goodneſs. For in this condition the Water nouriſhes and maintains innumerable Multitudes of various kinds of Fiſhes: and the dry Land ſupports and feeds as great varieties

of

of Plants and Animals, which have there firm Footing and Habitation. Whereas had all been *Earth*, all the ſpecies of *Fiſhes* had been loſt, and all thoſe Commodities which the Water affords us; or all *Water*, there had been no living for Plants or Terreſtrial Animals, or Man himſelf, and all the Beauty, Glory, and Variety of this inferiour World had been gone, nothing being to be ſeen, but one uniform dark Body of Water: or had all been mixt and made up of Water and Earth into one Body of Mud or Mire, as one would think, ſhould be moſt natural: for why ſuch a Separation as at preſent we find ſhould be made, no account can be given, but Providence. I ſay, had all this Globe been Mire or Mud, then could there have been no poſſibility for any *Animals* at all to have lived, excepting ſome few, and thoſe very dull and inferiour ones too. That therefore the *Earth* ſhould be made thus, and not only ſo, but with ſo great variety of parts, as Mountains, Plains, Vallies, Sand, Gravel, Lime, Stone, Clay, Marble, Argilla, &c. which are ſo delectable and pleaſant, and likewiſe ſo uſeful and convenient for the breeding and living of various Plants and Animals; ſome affecting Mountains, ſome Plains, ſome Vallies, ſome Watery Places, ſome Shade,

ſome Sun, ſome Clay, ſome Sand, ſome Gravel, &c. That the Earth ſhould be ſo figured as to have Mountains in the Mid-land parts, abounding with Springs of Water pouring down Streams and Rivers for the neceſſities and conveniencies of the Inhabitants of the lower Countries; and that the Levels and Plains ſhould be formed with ſo eaſie a declivity as to caſt off the Water, and yet not render Travelling or Tillage very Difficult or Laborious. Theſe things I ſay, muſt needs be the reſult of Counſel, Wiſdom, and Deſign. Eſpecially when (as I ſaid before) not that way which ſeems more facile and obvious to Chance is choſen, but that which is more difficult and hard to be traced, when it is moſt convenient and proper for thoſe nobler Ends and Deſigns, which were intended by its Wiſe Creator and Governor. Add to all this, that the whole dry Land is for the moſt part, covered over with a lovely Carpet of green Graſs and other Herbs, of a colour, not only moſt grateful and agreeable, but moſt uſeful and ſalutary to the Eye: and this alſo decked and adorned with great variety of Flowers of beautiful Colours and Figures, and of moſt pleaſant and fragrant Odours for the refreſhment of our Spirits and our innocent Delight.

A Second particular I have made choice of, more exactly to ſurvey and conſider, is the Body of Man: wherein I ſhall endeavour to diſcover ſomething of the Wiſdom and Goodneſs of God. Firſt, By making ſome general Obſervations concerning the Body. Secondly, By running over and diſcourſing upon its principal Parts and Members.

1. Then in general I ſay, the Wiſdom and Goodneſs of God appears in the *erect Poſture* of the Body of Man, which is a Priviledge and Advantage given to Man, above other Animals. But though this be ſo, yet I would not have you think, that all the Particulars I ſhall mention, are proper only to the Body of Man, divers of them agreeing to many other Creatures. It is not my Buſineſs to conſider only the Prerogatives of Man above other Animals, but the Endowments and Perfections which Nature hath conferred on his Body though common to them with him. Of this *erection* of the *Body* of Man, the Ancients have taken Notice as a particular Gift and Favour of God.

Ovid. Metam. 1.

Pronáq; cùm ſpectent Animalia cætera terrã,
Os hominum ſublime dedit, cælúmq; tueri
Juſſit, & erectos ad Sydera tollere vultus.

And before him, *Tully* in his Second Book *De Nat. Deorum.*

Ad hanc providentiam naturæ tam diligentem támq; ſolertem adjungi multa poſſunt, è quibus intelligatur quantæ res hominibus à Deo, quámq; eximiæ tributæ ſunt, qui primùm eos humo excitatos, celſos & erectos conſtituit, ut Deorum cognitionem cælum intuentes capere poſſent. Sunt enim è terra homines, non ut incolæ atq; habitatores, ſed quaſi ſpectatores ſuperarum rerum atq; cæleſtium, quarum ſpectaculum ad nullum aliud genus animantium pertinet.

Man being the only Creature in this ſublunary World, made to contemplate Heaven, it was convenient that he ſhould have ſuch a Figure or *Situs* of the parts of his Body, that he might conveniently look upwards. But to ſay the Truth in this reſpect of contemplating the Heavens or looking upwards, I do not ſee what advantage a man hath by this erection above other Animals, the Faces of moſt of them being more ſupine than ours, which are only perpendicular to the *Horizon*, whereas ſome of theirs ſtand reclining. But yet two or three other Advantages we have ofthis Erection, which I ſhall here mention.

Firſt,

First, It is more commodious for the ſuſtaining of the Head, which being full of Brains and very heavy (the Brain in Man being far larger in proportion to the Bulk of his Body, than in any other Animal)would have been very painful and wearisome to carry, if the Neck had lain parallel or inclining to the Horizon.

Secondly, This Figure is moſt convenient for Proſpect and looking about one. A man may ſee further before him, which is no ſmall advantage for avoiding Dangers, and diſcovering whatever he ſearches after.

Thirdly, The conveniency of this Site of our Bodies will more clearly appear, if we conſider what a pitiful condition we had been in, if we had been conſtantly neceſſitated to ſtand and walk upon all Four, Man being by the make of his Body, of all Quadrupeds (for now I muſt compare him with them) the moſt unfit for that kind of *inceſſus*, as I ſhall ſhew anon. And beſides that we ſhould have wanted, at leaſt in a great meaſure, the uſe of our Hand, that unvaluable Inſtrument, without which we had wanted moſt of thoſe advantages we enjoy as reaſonable Creatures, as I ſhall more particularly demonſtrate afterwards.

But it may be perchance objected by ſome, that Nature did not intend this Erection of the Body, but that it is ſuperinduced and artificial;

artificial; for that Children at firſt creep on all Four, according to that of the Poet.

Mox Quadrupes, ritúque tulit ſua membra ferarum. Ovid.

To which I anſwer, that there is ſo great an inequality in the length of our Legs and Arms, as would make it extremely inconvenient, if not impoſſible, for us to walk upon all Four, and ſet us almoſt upon our Heads; and therefore we ſee that Children do not creep upon their Hands and Feet, but upon their Hands and Knees; ſo that it is plain that Nature intended us to walk as we do, and not upon all Four.

2. I argue from the *Situs* or poſition of our Faces; for had we been to walk upon all Four we had been the moſt prone of all Animals, our Faces being parallel to the Horizon and looking directly downwards.

3. The greatneſs and ſtrength of the Muſcles of the Thighs and Legs above thoſe of the Arms, is a clear indication, that they were by Nature intended for a more difficult and laborious Action, even the moving and transferring the whole Body, and that Motion to be ſometimes continued for a great while together.

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As for that Argument taken from the contrary flexure of the Joynts of our Arms and Legs to that of Quadrupeds; as that our Knees bend forward, whereas the ſame Joynt of their hind-Legs bends backward; and that our Arms bend backward, whereas the Knees of their fore-Legs bend forward. Although the Obſervation be as old as *Ariſtotle*, becauſe I think there is a miſtake in it, in not comparing the ſame Joynts (for the firſt or uppermoſt Joynt in a Quadrupeds hind-Legs bends forward as well as a Mans Knees, which anſwer to it being the uppermoſt Joynt of our Legs; and the like *mutatis mutandis* may be ſaid of the Arms) I ſhall not inſiſt upon it.

II. The Body of Man may thence be proved to be the effect of Wiſdom, becauſe there is nothing in it deficient, nothing ſuperfluous, nothing but hath its End and Uſe; ſo true are thoſe Maximes we have already made uſe of, *Natura nihil facit fruſtra*, and *Natura non abundat in ſuperfluis, nec deficit in neceſſariis*, no part that we can well ſpare. *The Eye cannot ſay to the Hand I have no need of thee, nor the Head to the Feet I have no need of you.* 1. *Cor.* 12. 21. that I may uſurp the Apoſtles ſimilitude.

The Belly cannot quarrel with the Members, nor they with the Belly for her ſeeming

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ing Sloth; as they provide Meat for her, ſo ſhe concocts and diſtributes it to them: Only it may be doubted to what uſe the *Paps* in Men ſhould ſerve. I anſwer partly for Ornament, partly for a kind of conformity between the Sexes, and partly to defend and cheriſh the Heart; in ſome they contain Milk, as in a *Daniſh* Family we read of in *Bartholines* Anatomical Obſervations. However it follows not that they or any other parts of the Body are uſeleſs becauſe we are ignorant.

Had we been born with a large Wen upon our Faces, or a *Bavarian* Poke under our Chins, or a great Bunch upon our Backs like *Camels*, or any the like ſuperfluous excreſcency, which ſhould be not only uſeleſs but troubleſome, not only ſtand us in no ſtead but alſo be ill-favoured to behold, and burthenſom to carry about, then we might have had ſome pretence to doubt whether an intelligent and bountiful Creator had been our Architect; for had the Body been made by chance it muſt in all likelyhood have had many of theſe ſuperfluous and unneceſſary Parts.

But now ſeeing there is none of our Members but hath its Place and Uſe, none that we could ſpare or conveniently live without, were it but thoſe we account Excrements,

ments, the Hair of our Heads, or the Nails on our Fingers ends; we muſt needs be mad or ſottiſh if we can conceive any other than that an infinitely good and wiſe God was our Author and Former.

III. We may fetch an Argument of the Wiſdom and Providence of God from the convenient ſituation and diſpoſition of the Parts and Members of our Bodies: They are ſeated moſt conveniently for Uſe, for Ornament, and for mutual Aſſiſtance. Firſt, for Uſe; So we ſee the Senſes of ſuch eminent Uſe for our well-being, ſituate in the Head, as Sentinels in a Watch-Tower, to receive and conveigh to the Soul the impreſſions of external Objects. *Senſus autem interpretes ac nuntii rerum in capite tanquam in arce mirificè ad uſus neceſſarios & facti & collati ſunt. Cic. de Nat. Deorum.* The Eye can more eaſily ſee things at a diſtance, the Ear receive ſounds from afar: How could the Eye have been better placed either for Beauty and Ornament, or for the Guidance and Direction of the whole Body. As *Cicero* proceeds well, *Nam Oculi tanquam ſpeculatores altiſſimum locum obtinent, ex quo plurima conſpicientes funguntur ſuo munere: Et Aures quæ ſonum recipere debent, qui naturâ in ſublime fertur, rectè in altis corporum partibus collocatæ ſunt; itemq; Nares,*

res, eò quò omnis odor ad ſuperiora fertur, rectè ſurſum ſunt. For the Eyes like Sentinels occupy the higheſt place, from whence ſeeing many things they perform their functions: And the Ears, which are made for the reception of ſounds, which naturally are carried upwards, are rightly placed in the uppermoſt parts of the Body; alſo the Noſtrils, becauſe all odors aſcend, are fitly ſituate in the ſuperior parts. I might inſtance in the other Members. How could the Hands have been more conveniently placed for all ſorts of Exerciſes and Works, and for the guard and ſecurity of the Head and Principal Parts? The Heart to diſpenſe Life and Heat to the whole Body, *viz.* near the Center, and yet becauſe it is harder for the Blood to aſcend than deſcend, ſomewhat nearer the Head. It is alſo obſervable that the Sinks of the Body are removed as far from the Noſe and Eyes as may be; which *Cicero* takes notice of in the forementioned place. *Ut in Ædificiis Architecti avertunt ab Oculis & Naribus Dominorum ea quæ profluentia neceſſariò eſſent tetri aliquid habitura, ſic natura res ſimiles procul amandavit à ſenſibus.* Secondly, For Ornament. What could have been better contrived than that thoſe Members which are Pairs, ſhould ſtand by one another in equal altitude, and

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anſwer on each ſide one to another. And Thirdly, For mutual Aſſiſtance. We have before ſhewed how the Eye ſtands moſt conveniently for guiding the Hand, and the Hand for defending the Eye; and the like might be ſaid of the other Parts, they are ſo ſituate as to afford direction and help one to another. This will appear more clearly if we imagine any of the Members ſituate in contrary Places or Poſitions: Had a mans Arms been fitted only to bend backwards behind him, or his Legs only to move backwards; what direction could his Eyes then have afforded him in working or walking? or how could he then have fed himſelf? nay had one Arm been made to bend forward and the other directly backward, we had then loſt half the uſe of them, ſith they could not have aſſiſted one the other in any Action. Take the Eyes or any other of the Organs of Senſe, and ſee if you can find any ſo convenient a ſeat for them in the whole Body as that they now poſſeſs.

Fourthly, From the ample Proviſion that is made for the Defence and Security of the principal Parts: Thoſe are, 1. The *Heart*; which is the Fountain of Life and Vegetation, *Officina ſpirituum vitalium, principium & fons caloris nativi, lucerna humidi radicalis,*

dicalis, and that I may ſpeak with the Chymiſts, *ipſe Sol microcoſmi*, the very *Sun* of the *microcoſme* or little World, in which is contained that vital Flame or Heavenly Fire, which *Prometheus* is fabled to have ſtole from *Jupiter*: or as *Ariſtotle* phraſes it, that Ἀνάλογον τῷ τῶν ἀπλανῶν στοιχείῳ, *Divinum quid reſpondens elemento Stellarum.* This for more ſecurity is ſituate in the Center of the Trunk of the Body, covered firſt with its own Membrane called *Pericardium*, lodged within the ſoft Bed of the Lungs, encompaſſed round with a double Fence, (1.) of firm Bones or Ribs to bear off blows. (2.) of thick Muſcles and Skin, beſides the Arms conveniently placed to fence off any violence at a diſtance, before it can approach to hurt it. 2. The *Brain*, which is the principle of all Senſe and Motion, the Fountain of the Animal Spirits, the chief Seat and Palace Royal of the Soul; upon whoſe ſecurity depends whatever Privilege belongs to us as Senſitive or Rational Creatures. This, I ſay, being the prime and immediate Organ of the Soul, from the right conſtitution whereof proceeds the quickneſs of Apprehenſion, acuteneſs of Wit, ſolidity of Judgment, method and order of Invention, ſtrength and power of Memory; which if once weakened and diſordered,

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there follows nothing but Confuſion and Diſturbance in our Apprehenſions, Thoughts and Judgments, is environed round about with ſuch a potent Defence, that it muſt be amighty Force indeed that is able to injure it.

Firſt, A Skull ſo hard, thick, and tough, that it is almoſt as eaſie to ſplit a Helmet of Iron as to make a fracture in it. 2. This covered with Skin and Hair, which ſerve to keep it warm being naturally a very cold part, and alſo to quench and diſſipate the force of any ſtroke that ſhall be dealt it, and retund the edge of any Weapon. 3. And yet more than all this there is ſtill a thick and tough Membrane which hangs looſer about it, and doth not ſo cloſely embrace it (that they call *dura mater*) and in caſe the Skull happens to be broken doth often preſerve it from injury and diminution: And laſtly, a thin and fine Membrane ſtrait and cloſely adhering to keep it from quaſhing and ſhaking.

I might inſtance (3.) in the *Lungs*, which are ſo uſeful to us as to Life and Senſe, that the vulgar think our Breath is our very Life, and that we breath out our Souls from thence. Suteable to which notion both *anima* and *ſpiritus* in Latine, and πνεῦμα in Greek are derived from words that ſignifie

ſie Breath and Wind: And *efflare* or *exhalare animam* ſignifies to Die. And the old *Romans* uſed to apply mouth to mouth, and receive the laſt gaſps of their dying friends, as if their Souls had come out that way. From hence perhaps might firſt ſpring that opinion of the vehicles of Spirits; the Vulgar, as I hinted before, conceiving that the Breath was, if not the Soul itſelf, yet that wherein it was wafted and carried away. Theſe *Lungs*, I ſay, are for their bettter ſecurity and defence ſhut up in the ſame Cavity with the Heart.

Fourthly, In the abundant proviſion that is made againſt evil Accidents and Inconveniencies. And the liberality of Nature as to this particular appears 1. In that ſhe hath given many Members, which are of eminent uſe by pairs, as two Eyes, two Ears, two Noſtrils, two Hands, two Feet, two Breaſts, [*mammæ*] two Reins: That ſo if by any croſs or unhappy accident one ſhould be diſabled or rendred uſeleſs, the other might ſerve us tolerably well, whereas had a Man but one Hand, or one Eye, *&c.* if that were gone, all were gone, and we left in evil Caſe. See then and acknowledg the Benignity of the Deity, who hath beſtowed upon us two Hands, and two Eyes, and other the like parts not only for our Neceſ-

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ſity but Conveniency, ſo long as we enjoy them: and for our Security in caſe any miſchance deprive us of one of them. 2. In that all the Veſſels of the Body have many Ramifications: Which particular Branches, though they ſerve mainly for one Member or Muſcle, yet ſend forth ſome twigs to the neighbouring Muſcles; and ſo interchangeably the branches that ſerve theſe, ſend to them: So that if one Branch chance to be cut off or obſtructed, its defect may in ſome meaſure be ſupplied by the twigs that come from the neighbouring Veſſels. 3. In that ſhe hath provided ſo many ways to evacuate what might be hurtful to us or breed Diſeaſes in our Bodies. If any thing oppreſs the Head ſhe hath a power to free itſelf by Sneezing: If any thing fall into the Lungs, or if any Humor be diſcharged upon them, they have a faculty of clearing themſelves and caſting it up by Coughing: If any thing clog or burden the Stomach, it hath an ability of contracting itſelf and throwing it up by Vomit. Beſides theſe ways of Evacuation there are Siege, Urine, Sweating *hæmorrhagies* from the Noſe and *hæmorrhoidal* veins, Fluxes of Rheum. Now the reaſon why Nature hath provided ſo many ways of Evacuation is becauſe of the different humors that are to be avoided or caſt out.

When therefore there is a Secretion made of any noxious Humor, it is carried off by that Emunctory whoſe Pores are fitted to receive and tranſmit the minute parts of it; if at leaſt this Separation be made by Percolation, as we will now ſuppoſe, but not aſſert. Yet I doubt not but the ſame Humor may be caſt off by divers Emunctories, as is clear in Urine and Sweat which are for the main the ſame Humor carried off ſeveral ways.

Fifthly, From the Conſtancy that is obſerved in the Number, Figure, Place, and Make of all the principal Parts; and from the Variety in the leſs. Man is always mending and altering his Works: But Nature obſerves the ſame tenour, becauſe her works are ſo perfect that there is no place for amendments; nothing that can be reprehended. The ſagacious Men in ſo many Ages have not been able to find any flaw in theſe Divinely contrived and formed Machins, *no blot or errour in this great Volume of the World, as if any thing had been an imperfect Eſſay at the firſt*; to uſe the Biſhop of *Cheſters* words: Nothing that can be altered for the better; nothing but if it were altered would be marred. This could not have been, had Mans Body been the work of Chance and not Counſel and Providence. Why ſhould

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there be conſtantly the ſame Parts? Why ſhould they retain conſtantly the ſame Places? Why ſhould they be endued with the ſame Shape and Figure? Nothing ſo contrary as Conſtancy and Chance. Should I ſee a man throw the ſame number a thouſand times together upon but three Dice, could you perſwade me that this were accidental and that there was no neceſſary Cauſe of it? How much more incredible then is it that Conſtancy in ſuch a Variety, ſuch a multiplicity of parts ſhould be the reſult of Chance? Neither yet can theſe Works be the effects of Neceſſity or Fate, for then there would be the ſame Conſtancy obſerved in the ſmaller as well as the larger Parts and Veſſels; whereas there we ſee Nature doth *ludere*, as it were, ſport itſelf, the minute Ramifications of all the Veſſels, Veins, Arteries, and Nerves infinitely varying in individuals of the ſame Species, ſo that they are not in any two alike.

Sixthly, The great Wiſdom of the Divine Creator appears in that there is Pleaſure annexed to thoſe Actions that are neceſſary for the Support and Preſervation of the *individuum*, and the Continuation and Propagation of the *ſpecies*; and not only ſo, but Pain to the neglect or forbearance of them. For the ſupport of the Perſon

it hath annexed Pleaſure to Eating and Drinking: Which elſe out of Lazineſs or multiplicity of Buſineſs a man would be apt to neglect, or ſometime forget. Indeed to be obliged to chew and ſwallow meat daily for two hours ſpace, and to find no Reliſh nor Pleaſure in it, would be one of the moſt burthenſome and ungrateful tasks of a mans whole Life. But becauſe this Action is abſolutely neceſſary, for abundant ſecurity Nature hath inſerted in us a painful ſenſe of Hunger to put us in mind of it, and to reward our performance hath adjoined Pleaſure to it. And as for the continuation of Kind, I need not tell you that the Enjoyments which attend thoſe Actions are the higheſt Gratifications of Senſe.

Seventhly, The wonderful Art and Providence of the contriver and former of our Bodies appears in the multitude of intentions he muſt have in the Formation of the ſeveral Parts, or the qualifications they require to fit them for their ſeveral Uſes. * *Galen* in his Book *de formatione fœtus*, 'takes 'notice that there are in a humane Body 'above 600. ſeveral Muſcles, and there are 'at leaſt ten ſeveral Intentions or due Qua-'lifications to be obſerved in each of theſe; 'proper Figure, juſt Magnitude, right Diſpoſition

* *Biſhop of* Cheſters *Nat. Rel. lib.* 1. *c.* 6.

' position of its ſeveral Ends, upper and
' lower, Poſition of the whole, the inſerti-
' on of its proper Nerves, Veins, and Ar-
' teries, which are each of them to be du-
' ly placed; ſo that about the Muſcles a-
' lone no leſs than 6000 ſeveral ends or
' aims are to be attended to. The Bones
' are reckoned to be 284. The diſtinct
' Scopes or Intentions in each of theſe are
' above 40, in all about 100000. And
' thus is it in ſome proportion with all the
' other parts, the *Skin*, *Ligaments*, *Veſſels*,
' *Glandules*, *Humors*: But more eſpecially
' with the ſeveral Members of the Body,
' which do in regard of the great variety
' and multitude of thoſe ſeveral Intentions
' required to them, very much exceed the
' *homogeneous* Parts. And the failing in a-
' ny one of theſe would cauſe Irregularity
' in the Body, and in many of them ſuch
' as would be very notorious. Now to ima-
gine that ſuch a Machine compoſed of ſo many Parts, to the right Form, Order and Motion whereof ſuch an infinite number of Intentions are required, could be made without the Contrivance of ſome wiſe Agent, muſt needs be irrational in the higheſt degree.

Eighthly, Some fetch an Argument of Providence from the variety of Lineaments in the Faces of Men, which is such, that there are not two Faces in the World absolutely alike; which is somewhat strange, since all the Parts are in *Specie* the same. Were Nature a blind Architect, I see not but the Faces of some Men might be as like as Eggs laid by the same Hen, or Bullets cast in the same Mould, or drops of Water out of the same Bucket. This particular I find taken notice of by *Pliny* in his 7. *Book, Cap.* 1. in these Words, *Jam in facie vultuque nostro, cum sint decem aut paulò plura membra, nullas duas in tot millibus hominum indiscretas effigies existere, quod Ars nulla in paucis numero præstet affectando*; to which among other things he thus prefaces, *Naturæ verò rerum vis atque majestas in omnibus momentis fide caret.*

Though this at first may seem to be a Matter of small moment, yet if duly considered, it will appear to be of mighty importance in all Human Affairs: For should there be an undiscernable similitude between divers Men, what Confusion and Disturbance would necessarily follow? what Uncertainty in all Sales and Conveyances, in all Bargains and Contracts? what Frauds and Cheats and suborning of Witnesses? what

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a Subverſion of all Trade and Commerce? what hazard in all judicial Proceedings? in all Aſſaults and Batteries, in all Murthers and Aſſaſſinations, in Thefts and Robberies, what Security would there be to Maleſactors? who could ſwear that ſuch and ſuch were the Perſons that committed the Facts, though they ſaw them never ſo clearly? Many other inconveniences might be inſtanced in: So that we ſee this is no contemptible Argument of the Wiſdom and Goodneſs of God.

I have done with my general Obſervations. I proceed now more accurately and minutely to conſider ſome particular Parts or Members of the Body; and Firſt the *Head*, becauſe it was to contain a large Brain made of the moſt capacious Figure, as near as could be to a Spherical; upon this grows the Hair, which though it be eſteemed an Excrement, is of great uſe (as I ſhewed before) to cheriſh and keep warm the Brain, and to quench the force of any ſtroke that might otherwiſe endanger the Skull. It ſerves alſo to disburthen the Brain of a great deal of ſuperfluous moiſture, wherewith it abounds; and for a graceful Ornament to the Face.

Secondly, Another Member which I ſhall more particularly treat of, is the *Eye*, a part

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ſo artificially compoſed, and commodiouſly ſituate, as nothing can be contrived better for Uſe, Ornament or Security; nothing to advantage added thereto or altered therein. Of the Beauty of the Eye I ſhall ſay little, leaving that to Poets and Orators; that it is a very pleaſant and lovely Object to behold, if we conſider the Figure, Colors and Splendor of it, is the leaſt that I can ſay. The Soul as it is more immediately and ſtrongly moved and affected by this part than any other; ſo doth it manifeſt all its Paſſions and Perturbations by this. As the Eyes are the Windows to let in the *Species* of all exterior Objects into the dark Cels of the Brain, for the information of the Soul; ſo are they flaming Torches to reveal to thoſe abroad how the Soul within is moved or affected. Theſe Repreſentations made by the impreſſions of external Objects upon the Eye are the moſt clear, lively and diſtinct of any others. Now to this uſe and purpoſe of informing us what is abroad round about us in this aſpectable World, we ſhall find the Structure and Mechaniſm of the Eye, and every Part thereof ſo well fitted and adapted, as not the leaſt Curioſity can be added. For firſt of all, all the Humors and Tunicles are purely tranſparent, to let in the Light and

Colors

Colors unfolded and unſophiſticated by any inward Tincture. It is uſually ſaid by the *Peripateticks*, that the Cryſtalline Humor of the Eye (which they ineptly fanſied to be the immediate Organ of Viſion wherein all the Species of external Objects were terminated) is without all Color, becauſe its office was to diſcern all Colors, or at leaſt to receive the Species of ſeveral Colors, and convey them to the common Senſe. Now if itſelf had been coloured, it would have tranſmitted all viſible Objects tinctured with the ſame Color; as we ſee whatever is beheld through a coloured Glaſs appears of the ſame Color with the Glaſs, and to thoſe that have the Jaundice or the like Suffuſion of Eyes, Objects appear of that ſame Color wherewith their Eyes are infected. This they ſay is in a great meaſure true, although they are much miſtaken about the Organ and manner of Viſion, and the Uſes of the Humors and Membranes of the Eye. Two Reaſons therefore may be aſſigned why all the Membranes and Humors of the Eye are perfectly pellucid and void of Color. Firſt, for the Clearneſs. Secondly, for the Diſtinctneſs of Viſion.

I. The Clearneſs. For had the Tunicles and Humors of the Eye, all or any of them been colorate, many of the Rays proceeding

ing from the visible Object would have been stopt and suffocated before they could come to the bottom of the Eye, where the formal Organ of Vision is situate. For it is a most certain Rule, how much any Body hath of Colour, so much hath it of Opacity, and by so much the more unfit is it to transmit the Species. 2. For the Distinctness of Vision. For, as I said before and the Peripateticks observe well, were the Humours of the Eye tinctured with any colour, they would refund that colour upon the Object, and so it would not be represented to the Soul as in itself it is. So we see that through a coloured Glass things appear as well more dim and obscure, as tinctured with the colour thereof.

Secondly, The parts of the Eye are made convex, and especially the Crystalline Humour, which is of a lenticular Figure, convex on both sides, that by the Refractions there made there might be a direction of many Rays coming from one point in the Object, *viz.* as many as the Pupil can receive, to one point answerable in the bottom of the Eye; without which the Sense would be very obscure and also confused. There would be as much difference in the Clearness and Distinction of Vision, where the outward surface of the *tunica cornea* plain, and

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the Cryſtalline Humor removed; as between the Picture received on a white paper in a dark room through an open or empty hole, and the ſame received through a hole furniſhed with an exactly poliſhed lenticular Cryſtal; which how great it is any one that hath but ſeen this Experiment made, knows well enough. Indeed this Experiment doth very much explain the manner of Viſion; the hole anſwering to the Pupil of the Eye, the Cryſtalline Humour to the lenticular Glaſs, the dark Room to the cavity containing the vitreous Humour, and the white Paper to the *tunica retina*.

Thirdly, The Uveous Coat or *Iris* of the Eye hath a muſculous Power, and can dilate and contract that round hole in it, called the Pupil or Sight of the Eye. It contracts it for the excluding ſuperfluous Light, and preſerving the Eye from being injured by too vehement and lucid an Object, and again dilate it for the apprehending Objects more remote, or placed in a fainter light; *tam miro artificio* (ſaith *Scheiner*) *quàm munifica naturæ largitate*. If any one deſires to make experiment of theſe particulars, he may, following *Scheiner* and *Des Cartes* their directions, take a Child, and ſetting a Candle before him bid him look upon it: And he ſhall obſerve his Pupil to contract itſelf

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very much, to exclude the light, with the Brightness whereof it would otherwise be dazled and offended; as we are when after we have been some time in the dark a bright Light is suddenly brought in and set before us, till the Pupils of our Eyes have gradually contracted themselves: Let the Candle be withdrawn, or removed aside, he shall observe the Childs pupil by degrees to dilate itself. Or let him take a Bead or the like Object, and holding it near the Eye, command the Child to look at it, the Pupil will contract much when the Object is near; but let it be withdrawn to a greater distance in the same light, and he shall observe the pupil to be much enlarged.

Fourthly, The Uveous Coat, and also the inside of the *choroides* are blackened like the Walls of a Tennis Court, that the Rays may be there suffocated and suppressed, and not reflected backwards to confound the Sight: And if any be by the retiform Coat reflected, they are soon choaked in the black inside of the *Uvea*. Whereas were they reflected to and fro, there could be no distinct Vision; as we see the light admited into the dark Room we even now spake of, obliterates the *species* which before were seen upon the white Cloth or Paper.

Fifthly,

Fifthly, Becauſe the Rays from a nearer and from a more remote Object do not meet juſt in the ſame diſtance behind the Cryſtalline Humour (as may eaſily be obſerved in lenticular Glaſſes, where the point of concourſe of the Rays from a nearer Object is at a greater diſtance behind the Glaſs, and from a further at a leſſer) therefore the *ciliary proceſſes*, or rather the ligaments obſerved in the inſide of the Sclerotick Tunicle of the Eye, by a late ingenious Anatomiſt, do ſerve inſtead of a Muſcle, by their contraction to alter the figure of the Eye, and make it broader, and conſequently draw the *Retine* nearer to the Cryſtalline Humour, and by their relaxation ſuffer it to return to its natural diſtance according to the exigency of the Object, in reſpect of diſtance or propinquity: And beſides poſſibly the ciliary proceſſes may by their conſtriction or relaxation, render the Cryſtalline itſelf more gibboſe or plain; and with the help of the Muſcles a little alter the figure of the whole Eye, for the ſame reaſon. To what I have ſaid might be added, that the *retiform* tunicle is whitiſh, for the better and more true Reception of the *Species* of things. That there being a diſtance neceſſarily required for the collection of the Rays received by the Pupil, *viz.* thoſe that proceed from one point

of the Object to one point again in the bottom of the Eye, the *Retine* must needs be set at a distance from the Crystalline Humour: And therefore Nature hath provided a large Room, and filled it with the pellucid vitreous Humour most fit for that purpose.

I must not omit a notable Observation concerning the place of the insertion of the optick Nerve into the bulb of the Eye, and the reason of it; which I owe to that Learned Mathematician *Peter Herigon*, *Nervus Opticus* (saith he in his *Optica*) *ad latus ponitur, ne pars imaginis in ejus foramen incidens picturâ careat.* The Optick Nerve is not situate directly behind the Eye, but on one side, lest that part of the image that falls upon the hole of the Optick Nerve, should want its picture. This I do not conceive to be the true reason of this Situation; for even now as it is situate, that part of the Object whose rays fall upon the center or hole of the Optick Nerve, wants its picture, as we find by experience; that part not being seen by us, though we heed it not. But the reason is, because if the Optick *Axis* should fall upon this Center (as it would do were the Nerve seated just behind the Eye) this great Inconvenience would follow, that the middle point of every Ob-

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ject we viewed would be inviſible, or there would a dark ſpot appear in the midſt of it. Thus we ſee the admirable Wiſdom of Nature in thus placing the Optick Nerve in reſpect of the Eye; which he that did not conſider or underſtand would be apt to think more inconveniently ſituate for Viſion, than if it had been right behind.

Another thing alſo concerning Viſion is moſt remarkable, that though there be a decuſſation of the rays in the Pupil of the Eye, and ſo the image of the Object in the *Retina* or bottom of the Eye be inverted, yet doth not the Object appear inverted, but in its right or natural poſture: The reaſon whereof is becauſe the viſual Rays coming in ſtreight lines, by thoſe points of the Senſory or *Retina* which they touch, affect the common Senſe or Soul according to their direction; that is, ſignifie to it that thoſe ſeveral parts of the Object from whence they proceed lie in ſtreight lines (point for point) drawn through the Pupil to the ſeveral points of the Senſory where they terminate, and which they preſs upon. Whereupon the Soul muſt needs conceive the Object, not in an inverted but a right poſture. And that the Nerves are naturally made not only to inform the Soul of external Objects which preſs upon them, but alſo of

the ſituation of ſuch Objects, is clear, becauſe if the Eyes be diſtorted, the Object, will we nill we, will appear double. So if the fore and middle Fingers be croſs'd, and a round Body put between them and moved, it will ſeem to be two; the reaſon is, becauſe in that poſture of the Fingers the Body touches the outſides of them, which in their natural ſite are diſtant one from another, and their Nerves made to ſignifie to the Soul Bodies ſeparate and diſtant in like manner, two Fingers lying between them. And though our reaſon by the help of our Sight corrects this errour, yet cannot we but fanſie it to be ſo.

Neither is the *aqueous Humor*, as ſome may ſupinely imagine, altogether uſeleſs or unprofitable as to Viſion, becauſe by its help the *uvea tunica* is ſuſtained, which elſe would fall flat upon the Cryſtalline Humor; and fluid it muſt be, to give way to the contraction and dilatation of the Uveous: And becauſe the outermoſt Coat of the Eye might chance to be wounded or pricked, and this Humor being fluid let out, therefore Nature hath made Proviſion ſpeedily to repair it again in ſuch a Caſe.

Moreover it is remarkable that the *cornea tunica*, [horny or pellucid Coat of the Eye] doth not lie in the ſame *ſuperficies* with

with the White of the Eye, but riſeth up as it were a Hillock above its convexity, and is of an *Hyperbolical* or *Parabolical* Figure: So that though the Eye ſeems to be perfectly round, in reality it is not ſo, but the *Iris* thereof is protuberant above the White; and the Reaſon is becauſe that if the *cornea tunica* or Cryſtalline Humor had been concentrical to the *Sclerodes*, the Eye could not have admitted a whole Hemiſphere at one view, & *ſic Animalis incolumitati in multis rebus minùs cautum eſſet*, as *Scheiner* well. In many things there had not been ſufficient caution or care taken for the Animals ſafety.

And now (that I may uſe the Words of a late *Author of our own) the Eye is already ſo perfect, that I believe the reaſon of a Man would eaſily have reſted here, and admired at his own contrivance. For he being able to move his whole Body upward and downward and on every ſide, might have unawares thought himſelf ſufficiently well provided for; but Nature hath added Muſcles alſo to the Eyes, that no perfection might be wanting: For we have often occaſion to move our Eyes, our Head being unmoved, as in reading and viewing more particularly any Object ſet before us, by transferring the *axes* of our Eyes all o-

Dr. More Antidote againſt Atheiſm.

ver it: And that this may be done with the more Eaſe and Accuracy, ſhe hath furniſhed this Organ with no leſs than Six Muſcles, to move it upward, downward, to the Right and Left, obliquely and round about.

I ſhall now conſider what Proviſion is made for the Defence and Security of this moſt excellent and uſeful Part.

Firſt the Eyes are ſunk in a convenient Valley, *latent utiliter*, and are encompaſſed round with eminent Parts, as with a Rampart, *& excelſis undique partibus ſepiuntur*, *Cic.* ſo are defended from the ſtrokes of any flat or broad Bodies. Above ſtand the Eye-Brows to keep off any thing from running down upon them, as drops of Sweat from the Forehead, or Duſt, or the like. *Superiora ſuperciliis obducta ſudorem à capite & fronte defluentem repellunt.* Cic. Then follow the *Eye-lids*, which fence them from any ſudden and leſſer ſtripes. Theſe alſo round the edges are fortified with ſtiff briſtles, as it were Palliſadoes, againſt the incurſions of importunate Animals, ſerving partly as a Fan to ſtrike away Flyes or Gnats, or any other troubleſome Inſect; and partly to keep off ſuperfluous light, *Manitæq; ſunt palpebræ tanquam vallo pilorum, quibus & apertis oculis ſiquid incideret repelleretur.* I-

* *De natur. Rerum* l. 2.

dem

dem ibid. And becauſe it was neceſſary that Man and other Animals ſhould ſleep, which could not be ſo well done if the light came in by the Windows of the Eyes, therefore hath Nature provided theſe curtains to be then drawn to keep it out. And becauſe the outward coat of the Eye ought to be pellucid to tranſmit the light, which if the Eyes ſhould always ſtand open, would be apt to grow dry and ſhrink, and loſe their diaphaneïty, therefore are the Eylids ſo contrived as often to wink, that ſo they may as it were glaze and varniſh them over with the moiſture they contain, and withal wipe off whatever duſt or filth may ſtick to them: And this, leſt they ſhould hinder the ſight, they do with the greateſt celerity. *Cicero* hath taken notice that they are made very ſoft, leſt they ſhould hurt the Sight. *Molliſſimæ tactu nè læderent aciem, aptiſſimè factæ & ad claudendas pupillas ne quid incideret, & ad aperiendas, idq; providit ut identidem fieri poſſet maxima cum celeritate.*

Secondly, If we conſider the Bulb or Ball of the Eye, the exteriour Membrane or Coat thereof is made thick, tough, and ſtrong, that it is a very hard matter to make a rupture in it, and beſides ſo ſlippery that it eludes the force of any ſtroke, to which alſo its globular Figure gives it a very great advantage.

Laſtly, Becauſe for the guidance and direction of the Body in Walking and any Exerciſe, it is neceſſary the Eye ſhould be uncovered, and expoſed to the Air at all times and in all Weathers, therefore the moſt wiſe Author of Nature hath provided for it a hot bed of Fat which fills up the interſtices of the Muſcles; and beſides made it more patient and leſs ſenſible of cold than our other parts; and though I cannot ſay with *Cicero* abſolutely free from danger or harm by that Enemy, yet leaſt obnoxious to the injuries thereof of any part, and not at all, unleſs it be immoderate and extreme.

To all this I might add the convenience of the ſituation of the Eye in reſpect of its proximity to the Brain, the ſeat of Apprehenſion and Common Senſe: Whereas had they been further removed, the *Optic Nerves* had been liable to many more dangers and inconveniencies than now they are.

Seeing then the Eye is compoſed of ſo great variety of Parts all conſpiring to the Uſe of Viſion, whereof ſome are abſolutely neceſſary, others very uſeful and convenient, none idle or ſuperfluous, and which is remarkable, many of them of a different figure and conſiſtency from any others in the Body beſides, as being tranſparent, which it was abſolutely neceſſary they ſhould be, to tranſmit

mit the Rays of Light; Who can but believe that this Organ was deſigned and made purpoſely for the Uſe for which it ſerves?

Neither is it to be eſteemed any Defect or Imperfection in the Eyes of Man that they want the ſeventh Muſcle, or the nictating Membrane, which the Eyes of many other Animals are furniſhed withal; for though they be very uſeful, and in a manner neceſſary to them, conſidering their manner of living, yet are they not ſo to Man. To ſuch Beaſts as feed upon Graſs and other Herbs, and therefore are forced to hold their Eyes long in a hanging poſture, and to look downwards for the chuſing and gathering of their Food, the ſeventh or ſuſpenſory Muſcle is very uſeful, to enable them to do ſo without much pain or wearineſs; yet to Man, who doth not, nor hath any occaſion, indeed cannot hold his Head or look long downwards, it would be uſeleſs and ſuperfluous. As for the nictating Membrane or *Periophthalmium*, which all Birds, and I think moſt Quadrupeds are furniſhed with, I have been long in doubt what the uſe of it might be; and have ſometimes thought it was for the more abundant defence and ſecurity of the Eye; but then I was puzzled to give any tolerable account why Nature ſhould be more ſo-

licitous for the preservation of the Eyes of Brutes than Men, and in this respect also be a Stepmother to the most noble Creature.

* *Boyl* of Fin. Causes *p.* 53, 54.

But the Honble Author formerly mentioned, gives a probable account why Frogs and Birds are furnished with such a Membrane. Frogs, because being Amphibious Animals, designed to pass their lives in watery places, which for the most part abound with Sedges, and other Plants endowed with sharp edges or points; and the progressive Motion of this Animal being to be made not by Walking, but by Leaping, if his Eyes were not provided of such a sheath, he must either shut them, and so leap blindly and by consequence dangerously, or by leaving them open run a venture to have the *Cornea* cut, prickt, or otherwise offended by the edges or points of the Plants, or what may fall from them upon the Animals Eye: Whereas this Membrane (being something transparent as well as strong) is like a kind of Spectacle that covers the Eye without taking away the Sight. Birds are likewise furnished with it, because being destinated to fly among the Branches of Trees and Bushes, their Prickles, Twigs, Leaves or other Parts would be apt otherwise to wound or offend their Eyes. But yet still we are to seek why it is given

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to other Quadrupeds, whoſe Eyes are in no ſuch danger.

Thirdly, The *Ear* another Organ of Sence, how admirably is it contrived for the receiving and conveying of Sounds? Firſt, there is the outward Ear or *Auricula*, made hollow and contracted by degrees to draw the Sound inward, to take in as much as may be of it, as we uſe a Funnel to pour Liquor into any Veſſel. And therefore if the *Auricula* be cut clear off, the Hearing is much impaired, and almoſt quite marred, as hath been by experience found. From the *Auricula* is extended a ſmall long, round hole inward into the Head, to intend the Motion and ſo augment the force of the Sound, as we ſee in a ſhooting Trunk, the longer it is to a certain limit, the ſwifter and more forcibly the Air paſſes in it, and drives the Pellet. At the end of this hole is a Membrane, faſtned to a round bony Limb, and ſtretched like the head of a Drum, and therefore by Anatomiſts called alſo *Tympanum*, to receive the impulſe of the Sound, and to vibrate or quaver according to its reciprocal Motions or Vibrations; the ſmall Ear-bones being at the end faſtned to the *Tympanum*, and furniſhed with a Muſcle ſerve for the tenſion of that Membrane, or the relaxation of it according to the exigency

of

of the Animal, it being ſtretch'd to the utmoſt when it would hearken diligently to a lower or more diſtant Sound. Behind the Drum are ſeveral Vaults and anfractuoſe Cavities in the Ear-Bone, filled only with what Naturaliſts call the implanted Air; ſo to intend the leaſt ſound imaginable, that the Senſe might be affected with it; as we ſee in ſubterraneous Caves and Vaults how the Sound is redoubled, and what a great report it makes however moderate it be: And becauſe it was for the behoof of the *Animal*, that upon any ſudden Accident it might be awakened out of its ſleep, therefore were there no Shuts or Stopples made for the Ears, that ſo any loud or ſharp Noiſe might awaken it, as alſo a ſoft and gentle Voice or Murmur provoke it to ſleep. Now the Ears for the benefit and conveniences of the *Animal*, being always to ſtand open, becauſe there was ſome danger that Inſects might creep in thereat, and eating their way through the *tympanum* harbour in the Cavities behind it; therefore hath Nature loricated or plaiſtered over the ſides of the forementioned Hole with Ear-wax, to ſtop and entangle any Inſects that ſhould attempt to creep in there. But I muſt confeſs my ſelf not ſufficiently to underſtand the nature of Sounds to give a full and ſatisfacto-

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ry account of the Structure and Uſes of all the parts of the Ear.

Fourthly, The next part I ſhall take notice of ſhall be the *Teeth*, concerning which I find Seven Obſervations in the honorable Mr. *Boyls* Treatiſe of *Final Cauſes*, which I ſhall briefly recapitulate, and add one or two more.

I. That the Teeth alone among the Bones continue to grow in length during a mans whole Life, as appears by the unſightly length of one Tooth when its oppoſite happens to fall or be pulled out; which was moſt providently deſign'd to repair the waſt that is daily made of them by the frequent Attritions in Maſtication. Here by the by I might adviſe men to be careful how they attempt to cure this blemiſh by filing or cutting off the head of ſuch an overgrown Tooth, leſt that befal them which happened to a certain *Nun* in *Padua*, who upon cutting off a Tooth in that manner was preſently convulſed aud fell into an Epilepſſie, as *Bartholine* in his *Anatomy* reports.

II. That that part of the Teeth which is extant above the Gums is naked and not inveſted with that ſenſible Membrane called *Perioſteum*, wherewith the other Bones are covered,

III.

III. That the Teeth are of a cloſer and harder ſubſtance than the reſt of the Bones, for the more eaſie breaking and comminution of the more ſolid Aliments, and that they might be more durable and not ſo ſoon worn down by grinding the food.

IV. That for the nouriſhing and cheriſhing theſe ſo neceſſary Bones, the All wiſe Author of things has admirably contrived an unſeen Cavity in each ſide of the Jaw-bone, in which greater channel are lodged an Artery, a Vein and a Nerve, which through leſſer Cavities, as it were through Gutters, ſend their twigs to each particular Tooth.

V. Becauſe Infants were for a conſiderable time to feed upon Milk, which needs no chewing, and leſt Teeth ſhould hurt the tender Nipples of the Nurſe, Nature hath deferred the production of them for many Months in a humane *fœtus*, whereas thoſe of divers other Animals, which are reduced to ſeek betimes food that needs Maſtication, are born with them.

VI. The different Figure and Shape of the Teeth is remarkable, That the Foreteeth ſhould be formed broad and with a thin and ſharp edge like Chizzels, to cut off and take away a morſel from any ſolid Food, called therefore *inciſores*. The next, one on each ſide ſtronger and deeper rooted, and

more

more pointed, called therefore *Canini*, in English Eye-Teeth, to tear the more tough and reſiſting ſort of Aliments. The reſt called Jaw-Teeth or Grinders, in Latin *Molares*, are made flat and broad atop and withal ſomwhat uneven and rugged, that by their knobs and little cavities they may the better retain, grind and commix the Aliments.

VII. Becauſe the operations to be performed by the Teeth oftentimes require a conſiderable firmneſs and ſtrength, partly in the Teeth themſelves, partly in the inſtruments which move the lower Jaw, which alone is moveable, Nature hath provided this with ſtrong Muſcles, to make it bear forcibly againſt the upper Jaw. And thus not only placed each Tooth in a diſtinct Cavity of the Jaw-bone, as it were in a cloſe, ſtrong and deep ſocket, but has furniſhed the ſeveral ſorts of Teeth with Hold-faſts ſuitable to the ſtreſs that by reaſon of their different Offices they are to be put to. And therefore whereas the *Cutters* and *Eye-teeth* have uſually but one Root, (which in theſe laſt named is wont to be very long) the *Grinders* that are employed to crack Nuts, Stones of Fruit, Bones, or other hard Bodies, are furniſhed with three Roots, and in the upper Jaw often with four, becauſe theſe are pendulous, and the ſubſtance of the Jaw ſomewhat ſofter.

VIII.

VIII. The ſituation of the Teeth is moſt convenient, *viz.* the *Molares* or *Grinders* behind, neareſt the Center of Motion, becauſe there is a greater ſtrength or force required to chew the meat, than to bite a piece; and the *Cutters* before, that they may be ready to cut off a morſel from any ſolid Food, to be tranſmitted to the *Grinders*.

IX. It is remarkable that the Jaw in Men and ſuch Animals as are furniſhed with Grinders, hath an oblique or tranſverſe Motion, which is neceſſary for chewing and comminution of the Meat; which it is obſerved not to have in thoſe Animals that want the *Molares*.

Now if (as *Gallen* ſaith) he that ſhall marſhal a Company but of 32 Men in due order, is commended for a skilful and indoſtrious Perſon, ſhall we not admire Nature which hath ſo skilfully ranked and diſpoſed this Quire of our Teeth?

Fifthly, The *Tongue* is no leſs admirable for the contexture and manifold Uſes of it. Firſt, it is the Organ of Taſting; for being of a ſpungy ſubſtance the ſmall Particles of our Meat and Drink being mingled with the *Saliva*, eaſily inſinuate themſelves into the Pores of it, and ſo do either gratefully affect it, or harſhly grate upon it, accordingly as they are figured and moved; and

hereby

hereby we discern what is convenient or inconvenient for our nourishment. It helps us likewise in the chewing and swallowing of our Meat: and Lastly, It is the main Instrument of Speaking, a quality so peculiar to Man, that no Beast could ever attain to it. And although Birds have been taught to form some Words, yet they have been but a few, and those learn'd with great difficulty; but what is the chief, the Birds understand not the meaning of them, nor use them as Signs of Things or their own Conceptions of them; though they may use them as Expressions of their Passions: As Parrots having been used to be fed at the prolation of certain Words, may afterwards when they are hungry pronounce the same. For this *Des Cartes* makes his main Argument to prove that Brutes have no Cogitation, because the highest of them could never be brought to signifie their Thoughts or Conceptions by any artificial Signs, either Words, or Gestures, (which, if they had any, they would in all likelyhood be forward enough to do) whereas all Men, both Fools and Mutes, make use of Words or other Signs to express their Thoughts, about any Subjects that present themselves; which Signs also have no reference to any of their Passions. Whereas the Signs that Brute

Animals

Animals may be taught to use are no other than such as are the motions of some of their Passions, Fear, Hope, Joy, &c. Hence some of the *Jewish* Rabbins did not so absurdly define a Man *Animal loquens*, a speaking Creature. Having had occasion just now to mention the *Saliva* or Spittle, I am put in mind of the eminent use of this Humor, which is commonly taken for an Excrement. Because a great part of our Food is dry; therefore Nature hath provided several glandules to separate this juice from the Blood, and no less than four Channels to convey it into the Mouth, which are of late invention and called by Anatomists *Ductus Salivales*, through which the Saliva destilling continually, serves well to macerate and temper our meat, and make it fit to be chewed and swallowed. If a copious Moisture did not by these Conduit-pipes incessantly flow down into the Mouths of *Horses* and *Kine*, how were it possible they should for a long time together grind and swallow such dry meat as Hay and Straw? Moreover it may be useful not only in the Mouth but in the Stomach too, to promote Concoction.

Sixthly, To the Mouth succeeds the *Wind-pipe*, no less wonderful in its Conformation. For because continual Respiration is necessary for the support of our Lives, it is made with

with annulary Cartilages to keep it conſtantly open, and that the ſides of it may not flag and fall together. And leſt when we ſwallow, our meat or drink ſhould fall in there and obſtruct it, it hath a ſtrong ſhut or Valve called *Epiglottis*, to cover it cloſe, and ſtop it when we ſwallow: and for the more convenient bending of our Necks, it is not made of one entire continued Cartilage, but of many annular ones joined together by ſtrong Membranes, which Membranes are muſcular, compounded of ſtreight and circular Fibres for the more effectual contraction of the Windpipe in any ſtrong or violent Expiration or Coughing. And leſt the Aſperity or hardneſs of theſe Cartilages ſhould hurt the *Oeſophagus* or Gullet, which is tender and of a Skinny Subſtance, or hinder the ſwallowing of our Meat, therefore theſe annulary Griſtles are not made round, or entire Circles, but where the Gullet touches the Windpipe, there to fill up the Circle is only a ſoft Membrane, which may eaſily give way to the Dilatation of the Gullet. And to demonſtrate that this was deſignedly done for this End and Uſe, ſo ſoon as the Windpipe enters the Lungs, its Cartilages are no longer deficient, but perfect Circles or Rings, becauſe there was no neceſſity they ſhould be ſo, but it was more convenient they ſhould be

entire. Lastly, for the various modulation of the Voice, the upper end of the Wind-pipe is endued with several Cartilages and Muscles, to contract or dilate it as we would have our Voice Flat or Sharp; and moreover the whole is continually moistened with a glutinous Humor issuing out of the small Glandules that are upon its inner Coat, to fence it against the sharp Air received in, or Breath forced out; yet is it of quick and tender Sense, that it may be easily provoked to cast out by coughing, whatever may fall into it from without, or be discharged into it from within.

Seventhly, The *Heart* which hath been always esteemed, and really is, one of the principal Parts of the Body, the *primum vivens, & ultimum moriens*, by its uncessant Motion distributing the Blood, the Vehicle of Life, and with it the Vital Heat and Spirits, throughout the whole Body, whereby it doth continually irrigate, nourish and keep hot and supple all the Members. Is it not admirable that from this Fountain of Life and Heat there should be Channels and Conduit-pipes, to every, even the least and most remote Part of the Body; just as if from one Waterhouse there should be Pipes conveying the Water to every House in a Town, and to every Room in each House;

or

or from one Fountain in a Garden there ſhould be little Channels or Dikes cut to every Bed, and every Plant growing therein, as we have ſeen more than once done beyond the Seas. I confeſs the Heart ſeems not to be deſigned to ſo noble an Uſe as is generally believed, that is to be the Fountain or Conſervatory of the vital Flame, and to inſpire the Blood therewith; (for the Lungs ſerve rather for the accenſion or maintaining that Flame, the Blood receiving there from the Air thoſe Particles which are one Part of the *Pabulum* or Fewel thereof, and ſo impregnated running back to the Heart) but to ſerve as a Machine to receive the Blood from the Veins, and to force it out by the Arteries through the whole Body, as a Syringe doth any Liquor, though not by the ſame Artifice: And yet this is no ignoble Uſe, the continuance of the Circulation of the Blood being indiſpenſibly neceſſary for the quickening and enlivening of all the Members of the Body, and ſupplying of Matter to the Brain, for the preparation of the Animal Spirits, the Inſtruments of all Senſe and Motion. Now for this uſe of receiving and pumping out of the Blood, the Heart is admirably contrived. For Firſt being a Muſcular Part, the Sides of it are compoſed of two orders of Fi-

bres running circularly or spirally from Base to Tip, contrarily one to the other, and so being drawn or contracted contrary ways do violently constringe and straiten the Ventricles, and strongly force out the Blood, as we have formerly intimated. Then the Vessels we call *Arteries*, which carry from the Heart to the several Parts, have Valves which open outwards like Trap-doors, and give the Blood a free passage out of the Heart, but will not suffer it to return back again thither, and the *Veins*, which bring it back from the several Members to the Heart, have Valves or Trap-doors which open inwards, so as to give way to the Blood to run into the Heart, but prevent it from running back again that way. Besides the Arteries consist of a quadruple Coat, the Third of which is made up of annular or orbicular carneous Fibres to a good thickness and is of a Muscular Nature, after every Pulse of the Heart serving to contract the Vessel successively with incredible celerity, so by a kind of peristaltick Motion impelling the Blood onwards to the capillary Extremities, and through the Muscles, with great force and swiftness. So the Pulse of the Arteries is not only caused by the pulsation of the Heart, driving the Blood through them in manner of a Wave or Flush, as *Des Cartes*

and

and others would have it; but by the Coats of the Arteries themſelves, which the expe-riments of a certain * *Lovain* Phyſitian, (the firſt whereof is *Galens*,) do in my opinion make good againſt him. Firſt, ſaith he, if you ſlit the Artery and thruſt into it a Pipe, ſo big as to fill the Cavity of it, and caſt a ſtrait ligature upon that part of the Arte-ry containing the Pipe, and ſo bind it faſt to the Pipe; notwithſtanding the Blood hath free paſſage through the Pipe, yet will not the Artery beat below the ligature; but do but take off the ligature, it will commence again to beat immediately. But becauſe one might be ready to reply to this Expe-riment, that the reaſon why when bound it did not beat, was becauſe the current of the Blood being ſtraitned by the Pipe, when beneath the Pipe it came to have more li-berty, was not ſufficient to ſtretch the Coats of the Artery, and ſo cauſe a Pulſe, but when the ligature was taken off, it might flow between the encloſed tube and the Coat of the Artery; therefore he adds another, which clearly evinces that this could not be the reaſon, but that it is ſomething flow-ing down the Coats of the Artery that cauſes the Pulſe, that is, If you ſtraiten the Ar-tery never ſo much, provided the ſides of it do not quite meet, and ſtop all paſ-

* Cartes *Epiſt. Vol.* 1. *Ep.* 77. *& Seq.*

ſage of the Blood, the Veſſel will notwithſtanding continue ſtill to beat below or beyond the Coarctation. So we ſee ſome Phyſitians both Ancient (as *Galen*,) and Modern were of opinion that the Pulſe of the Arteries was owing to their Coats; though the firſt that I know of who obſerved the third Coat of an Artery to be a muſcular Body, compoſed of annulary Fibres, was Dr. *Willis*. The mention of the periſtaltick Motion puts me in mind of an ocular Demonſtration of it in the Gullet of Kine when they chew the Cud, which I have often beheld with pleaſure. For after they have ſwallowed one morſel, if you look ſtedfaſtly upon their Throat, you will ſoon ſee another aſcend, and run pretty ſwiftly all along the Throat up to the Mouth, which it could not do unleſs it were impelled by the ſucceſſive contraction or periſtaltick Motion of the Gullet, continually following it. And it is remarkable that theſe ruminant Creatures have a power by the *imperium* of their wills of directing this periſtaltick Motion upwards or downwards. I ſhall add no more concerning the Heart, but that it and the Brain do *mutuas operas tradere*, enable one another to work; for firſt the Brain cannot itſelf Live, unleſs it receive continual ſupplies of Blood from the Heart, much leſs can it

per-

perform its functions of preparing and distributing the Animal Spirits; nor the Heart Pulse, unless it receives Spirits or something else that descends from the Brain by the Nerves. For do but cut asunder the Nerves that go from the Brain to the Heart, the motion thereof in more perfect and hot Creatures ceaseth immediately. Which Part began this round is the Question.

Eighthly, The next Part I shall treat of shall be the *Hand*, this ὄργανον ὀργάνων or superlative Instrument, which serves us for such a multitude of Uses, as it is not easie to enumerate; whereto if we consider the Make and Structure of it, we shall find it wonderfully adapted. First, it is divided into Four Fingers bending forward, and one opposite to them bending backwards, and of greater strength than any of them singly, which we call the Thumb, to joyn with them severally or united; whereby it is fitted to lay hold of objects of any size or quantity. The least things, as any small single Seed, are taken up by the Thumb and Forefinger; those a little greater, by the Thumb and two Fingers, which also we chiefly employ to manage the Needle in Sewing, and the Pen in Writing: When we would take up a greater quantity of any thing we make use of the Thumb and

all the Fingers. Sometimes we uſe one Finger only, as in póinting at any thing, picking things out of holès or long and narrow Veſſels, ſometimes all ſeverally at one time, as in ſtopping the ſtrings when we play upon any muſical Inſtrument. 2. The Fingers are ſtrengthened with ſeveral Bones, jointed together for motion, and furniſhed with ſeveral Muſcles and Tendons like ſo many Pullies to bend them circularly forward; which is moſt convenient for the firm holding and griping of any Object: Which of how great, conſtant, and neceſſary Uſe it is in pulling or drawing, but eſpecially in taking up and retaining any ſort of Tool or Inſtrument to work withal in Huſbandry and all mechanick Arts, is ſo obvious to every mans Obſervation, that I need not ſpend time to inſtance in particulars: Moreover the ſeveral Fingers are furniſhed with ſeveral Muſcles to extend and open the Hand, and to move them to the Right and Left: and ſo this Diviſion and Motion of the Fingers doth not hinder but that the whole Hand may be employed, as if it were all of a piece, as we ſee it is, either expanded as in ſtriking out, ſmoothing and folding up of Cloths and ſome mechanick Uſes; or contracted, as in Fighting, Kneading of Dough and the like. It is alſo no-

table

table and indeed wonderful, that the Tendons bending the middle Joint of the Fingers, ſhould be perforated to give paſſage to the Tendons of the Muſcles which draw the uppermoſt Joynts, and all bound down cloſe to the Bone with ſtrong Fillets, leſt they ſhould ſtart up and hinder the Hand in its work, ſtanding like ſo many Bowſtrings. 3. The Fingers ends are ſtrengthened with Nails, as we fortifie the ends of our Staves or Forks with Iron Hoops or Ferules, which Nails ſerve not only for defence but for ornament, and many Uſes. The Skin upon our Fingers ends, is thin and of moſt exquiſite Senſe, to help us to judg of any thing we handle. If now I ſhould go about to reckon up the ſeveral Uſes of this Inſtrument, Time would ſooner fail me then Matter. By the help of this we do all our Works, we Build our ſelves Houſes to dwell in; we make our ſelves Garments to wear; we Plow and Sow our Grounds with Corn, Dreſs and Cultivate our Vineyards, Gardens, and Orchards, gather and lay up our Grain, and Fruits; we prepare and make ready our Victuals. Spinning, Weaving, Painting, Carving, Engraving, and that Divinely invented Art of Writing, whereby we tranſmit our own Thoughts to Poſterity, and converſe with and participate the Obſervations

and

and Inventions of them that are long ago Dead, all performed by this. This is the only Inſtrument for all Arts whatſoever; no improvement to be made of any experimental Knowledg without it. Hence (as *Ariſtotle* ſaith well) they do amiſs that complain, that Man is worſe dealt with by Nature than other Creatures; whereas they have ſome Hair, ſome Shels, ſome Wool, ſome Feathers, ſome Scales, to defend themſelves from the injuries of the Weather, Man alone is Born Naked and without all covering. Whereas they have natural Weapons to defend themſelves and offend their Enemies, ſome Horns, ſome Hoofs, ſome Teeth, ſome Talons, ſome Claws, ſome Spurs and Beaks; Man hath none of all theſe, but is weak, and feeble, and unarmed ſent into the World. Why, a Hand with Reaſon to uſe it, ſupplies the Uſes of all theſe, that's both a Horn, and a Hoof, and a Talon and a Tusk, *&c.* becauſe it enables us to uſe Weapons of theſe and other Faſhions, as Swords and Spears and Guns. Beſides this advantage a Man hath of them, that whereas they cannot at pleaſure change their coverings, or lay aſide their Weapons, or make uſe of others as occaſion ſerves, but muſt abide Winter and Summer, Night and Day with the ſame Cloathing on their Backs,

and

and sleep with their Weapons upon them; a Man can alter his Cloathing according to the exigency of the Weather, go warm in Winter, and cool in Summer, cover up himself hot in the Night, and lay aside his Cloaths in the Day, and put on or off more or fewer according as his Work and Exercise is: and can as occasion requires, make use of divers sorts of Weapons, and choice of such at all turns as are most proper and convenient; whereby we are enabled to subdue and rule over all other Creatures; and use for our own behoof those Qualities wherein they excel, as the Strength of the Ox, the Valor and Swiftness of the Horse, the Sagacity and Vigilancy of the Dog, and so make them as it were our own. Had we wanted this Member in our Bodies, we must have lived the Life of Brutes, without House or Shelter but what the Woods and Rocks would have afforded; without Cloths or Covering; without Corn, or Wine, or Oil, or any other Drink but Water; without the warmth and comfort, or other uses of Fire, and so without any Artificial Bak'd, Boil'd or Roast Meats; but must have scrambled with the wild Beasts for Crabs, and Nuts, and Akhorns, and Sallets, and such other things as the Earth puts forth of her own accord. We had lain open and exposed

poſed to Injuries, and had been unable to reſiſt or defend our ſelves againſt almoſt the weakeſt Creature.

The remaining Parts I ſhall but briefly run over.

That the *Back-bone* ſhould be divided into ſo many Vertebres for commodious bending, and not be one entire rigid Bone, which being of that length would have been often in danger of ſnapping in ſunder. That the ſeveral Vertebres ſhould be ſo Elegantly and Artificially compacted and joined together, that they are as ſtrong and firm as if they were but one Bone. That they ſhould be all perforated in the middle with a large hole for the ſpinal Marrow or Pith to paſs along; and each particular have a hole on each ſide to tranſmit the Nerves to the Muſcles of the Body, to convey both Senſe and Motion.

That whereas the *Breaſt* is encompaſſed with Ribs, the *Belly* is left free; that it might give way to the motion of the Midriff in Reſpiration; and to the neceſſary Reception of Meat and Drink; as alſo for the convenient bending of the Body; and in Females for that extraordinary extenſion that is requiſite in the time of their Pregnancy.

That

That the *Stomach* ſhould be Membranous, and capable of Dilatation and Contraction, according to the quantity of Meat conteined in it; that it ſhould be ſituate under the Liver, which by its Heat might cheriſh it, and contribute to Concoction: That it ſhould be endued with an acid Ferment, or ſome corruptive quality for ſo ſpeedy a diſſolution of the Meat, and preparation of Chyle; that after Concoction it ſhould have an ability of contracting itſelf and turning out the Meat.

That the *Bladder* ſhould be made of a membranous Subſtance, and ſo extremely dilatable for receiving and containing the Urine, till opportunity of emptying it; that it ſhould have Shuts for the ends of the Ureters ſo artificially contrived as to give the Urine free entrance, but to ſtop all paſſage backward, ſo that they will not tranſmit the Wind, though it be ſtrongly blown and forced in.

That the *Liver* ſhould continually ſeparate the Choler from the Blood, and empty it into the Inteſtines, where there is good uſe for it, not only to provoke Dejection, but alſo to attenuate the Chyle and render it ſo ſubtile and fluid as to enter in at the Orifices of the lacteous Veins.

Finally,

Finally, That all the Bones, and all the Muscles, and all the Vessels of the Body should be so admirably contrived, and adapted, and compacted together for their several Motions and Uses, and that most *Geometrically*, according to the strictest Rules of *Mechanicks*, that if in the whole Body you change the Figure, Situation, and Conjunction but of one Part, if you diminish or encrease the Bulk and Magnitude, in fine if you endeavor any Innovation or Alteration, you marr and spoil instead of mending. How can all these things put together but beget Wonder and Astonishment?

That under one Skin there should be such infinite variety of Parts, variously mingled, hard with soft, fluid with fixt, solid with hollow, those in rest with those in motion, some with cavities as Mortesses to receive, others with Tenons to fit those cavities; all these so pact and thrust so close together that there is no unnecessary Vacuity in the whole Body, and yet so far from clashing or interfering one with another, or hindring each others Motions, that they do all Friendly conspire, all help and assist mutually one the other, all concur in one general End and Design, the good and preservation of the whole, are certainly Arguments and Effects of infinite Wisdom and Counsel; so

that

that he muſt needs be worſe than mad that can find in his Heart to imagine all theſe to be caſual and fortuitous, or not provided and deſigned by a moſt wiſe and intelligent Cauſe.

I ſhould now proceed to treat of the Generation and Formation of the *Fætus* in the Womb; but that is a Subject too difficult for me to handle; the Body of Man and other Animals being formed in the dark Receſſes of the *Matrix*, or as the Pſalmiſt phraſes it, Pſal. 139. 14. *made in ſecret, and curiouſly wrought in the loweſt parts of the Earth.* This Work is ſo admirable and unaccountable that neither the Atheiſts nor mechanick Philoſophers have attempted to declare the manner and proceſs of it; but have (as I noted before) very cautiouſly and prudently broke off their Syſtems of Natural Philoſophy here, and left this point untoucht; And thoſe Accounts which ſome of them have attempted to give of the formation of a few of the parts, are ſo exceſſively abſurd and ridiculous, that they need no other Confutation than ha ha he. And I have already further ſhewn, that it ſeems to me impoſſible, that Matter divided into as minute and ſubtle Parts as you will or can imagine, and thoſe moved according to what Catholick Laws ſoever can be deviſed,

viſed, ſhould without the preſidency and direction of ſome intelligent Agent, by the mere agitation of a gentle Heat, run itſelf into ſuch a curious Machine as the Body of Man is.

Yet muſt it be confeſt, that the Seed of Animals is admirably qualified to be faſhioned and formed by the *Plaſtick Nature* into an Organical Body, conteining the Principles or component Particles of all the ſeveral homogeneous Parts thereof; for indeed every part of the Body ſeems to club and contribute to the Seed, elſe why ſhould Parents that are born Blind or Deaf, or that want a Finger or any other Part, or have one ſuperfluous, ſometimes generate Children that have the ſame defects or imperfections; and yet (which is wonderful) nothing of the Body or groſſer matter of the Seed comes near the firſt Principle of the *Fœtus*, or in ſome ſo much as enters the Womb, but only ſome contagious Vapor or ſubtle *effluviums* thereof. But to what ſhall we attribute the *Fœtus* its likeneſs to the Parents, or omitting them to the precedent Progenitors, as I have obſerved ſome Parents that have been both black Hair'd to have generated moſt red Hair'd Children, becauſe their Anceſtors Hair have been of that Color, or why are Twins ſo often

often extremely alike; Whether is this owing to the Efficient, or to the Matter?

These *Effluvia* we spake of of the Male Seed, as subtile as they are, yet have they a great, if not the greatest stroke in Generation, as is clearly demonstrable in a Mule, which doth more resemble the Male Parent, that is the Ass, than the Female or Horse. But now why such different *Species* should not only mingle together, but also generate an Animal, and yet that that hybridous Production should not again generate, and so a new Race be carried on; but Nature should stop here and proceed no further, is to me a Mystery and unaccountable.

One thing relating to Generation I cannot omit, that is, the construction of a set of temporary Parts, (like Scaffolds in a Building) to serve a present End, which are afterwards laid aside, afford a strong Argument of Counsel and Design. Now for the use of the Young during its enclosure in the Womb there are several Parts formed, as the Membranes inveloping it, called the *Secundines*, the umbilical Vessels, one Vein and two Arteries, the *Urachus*, to convey the Urine out of the Bladder, and the *placenta uterina*; part whereof fall away at the Birth, as the *Secundines* and *Placenta*, others degenerate into Ligaments, as the *Urachus*, and

part of the umbilical Vein: Besides which, because the *fœtus* during its abode in the Womb hath no use of respiration by the Lungs, the Blood doth not all, I may say not the greatest part of it, flow through them, but there are two Passages or Channels contrived, one called the *foramen ovale*, by which part of the Blood brought by the *vena cava* passeth immediately into the left Ventricle of the Heart, without entring the right at all; the other is a large arterial Channel passing from the pulmonary Artery immediately into the *Aorta*, or great Artery, which likewise derives part of the Blood thither, without running at all into the Lungs: These two are closed up soon after the Child is born, when it breaths no more (as I may so say) by the *Placenta uterina*, but respiration by the Lungs is needful for it. It is here to be noted, that though the Lungs be formed so soon as the other Parts, yet during the abode of the *fœtus* in the Womb, they lie by as useless. In like manner I have observed that in ruminating Creatures the three formost Stomachs, not only during the continuance of the Young in the Womb, but so long as it is fed with Milk are unemployed and useless, the Milk passing immediately into the fourth.

Another

Another Obſervation I ſhall add concerning Generation, which is of ſome moment, becauſe it takes away ſome conceſſions of Naturaliſts, that give countenance to the Atheiſts fictitious and ridiculous Account of the firſt production of Mankind and other Animals; *viz.* that all ſorts of Inſects, yea and ſome Quadrupeds too, as Frogs and Mice, are produced Spontaneouſly. My Obſervation and Affirmation is, that there is no ſuch thing in Nature, as Æquivocal or Spontaneous Generation, but that all Animals, as well ſmall as great, not excluding the vileſt and moſt contemptible Inſect, are generated by Animal-Parents of the ſame *Species* with themſelves; that noble *Italian* Vertuoſo, *Franceſco Redi* having experimented that no putrified Fleſh (which one would think were the moſt likely of any thing) will of itſelf, if all Inſects be carefully kept from it, produce any: The ſame Experiment I remember Doctor *Wilkins* late Biſhop of *Cheſter* told me had been made by ſome of the *Royal Society*. No inſtance againſt this Opinion doth ſo much puzzle me, as Worms bred in the Inteſtines of Man and other Animals. But ſeeing the round Worms do manifeſtly generate, and probably the other kinds too; it's likely they come originally from Seed, which how it was

brought into the Guts, may afterwards poſſibly be diſcovered. Moreover I am inclinable to believe that all Plants too, that themſelves produce Seed, (which are all but ſome very imperfect ones, which ſcarce deſerve the name of Plants) come of Seeds themſelves. For that great Naturaliſt *Malpighius*, to make experiment whether Earth would of its ſelf put forth Plants, took ſome purpoſely digged out of a deep Place, and put it into a Glaſs Veſſel, the top whereof he covered with Silk many times doubled and ſtrained over it, which would admit the Water and Air to paſs through, but exclude the leaſt Seed that might be wafted by the Wind; the event was that no Plant at all ſprang up in it; nor need we wonder how in a Ditch, Bank or Graſs-Plat newly dig'd, or in the Fenbanks in the Iſle of *Ely* Muſtard ſhould abundantly ſpring up, where in the Memory of Man none had been known to grow, for it might come of Seed which had lain there more than a Mans Age. Some of the Ancients mentioning ſome Seeds that retain their fecundity Forty Years: As for the Muſtard that ſprung up in the Iſle of *Ely*, though there never had been any in that Country, yet might it have been brought down in the Channels by the Floods, and ſo being thrown

up

up the Banks together with the Earth, might germinate and grow there.

From this Diſcourſe concerning the Body of Man I ſhall make Three Practical Inferences.

Firſt, Let us give thanks to Almighty God for the Perfection and Integrity of our Bodies. It would not be amiſs to put it into the Euchariſtical parr of our daily Devotions: We praiſe thee O God for the due Number, Shape and Uſe of our Limbs and Senſes, and in general of all the Parts of our Bodies; we bleſs thee for the ſound and healthful Conſtitution of them; *It is thou that haſt made us and not we our ſelves; in thy Book were all our Members written.* The Mother that bears the Child in her Womb is not conſcious to any thing that is done there; ſhe underſtands no more how the Infant is formed than itſelf doth. But if God hath beſtowed upon us any peculiar Gift or Endowment, wherein we excel others, as Strength, or Beauty or Activity, we ought to give him ſpecial thanks for it, but not to think the better of our ſelves therefore, or deſpiſe them that want it.

Infer. 1.

Pſal. 100.

Now becauſe theſe Bodily Perfections, being common Bleſſings, we are apt not at all to conſider them, or not to ſet a juſt value on them; and becauſe the worth of things

is beſt diſcerned by their want; it would be uſeful ſometimes to imagine or ſuppoſe our ſelves by ſome accident to be depriv'd of one of our Limbs or Senſes, as a Hand, or a Foot, or an Eye, for then we cannot but be ſenſible, that we ſhould be in worſe condition than now we are, and that we ſhould ſoon find a difference between two Hands and one Hand, two Eyes and one Eye, and that two excel one as much in worth as they do in number; and yet if we could ſpare the uſe of the loſt part, the deformity and unſightlyneſs of ſuch a defect in the Body, would alone be very grievous to us. Again, which is leſs, ſuppoſe we only, that our Bodies want of their juſt magnitude, or that they or any of our Members are crooked or diſtorted, or diſproportionate to the reſt either in exceſs or defect; nay, which is leaſt of all, that the due motion of any one part be perverted, as but of the Eyes in ſquinting, the Eye-lids in twinkling, the Tongue in ſtammering, theſe things are ſuch Blemiſhes and Offences to us, by making us Gazing-ſtocks to others, and Objects of their Scorn and Deriſion, that we could be content to part with a good part of our Eſtates to repair ſuch defects, or heal ſuch Infirmities. Theſe things conſidered and duly weighed, would ſurely be

be a great and effectual motive to excite in us Gratitude for this Integrity of our Bodies, and to esteem it no small blessing, I say a blessing and favor of God to us; for some there be that want it, and why might not we have been of that number? God was no way obliged to bestow it upon us.

And as we are to give thanks for the Integrity of our Body, so are we likewise for the Health of it, and the sound Temper and Constitution of all its Parts and Humors; Health being the principal blessing of this Life, without which we cannot enjoy or take comfort in any thing besides.

Neither are we to give thanks alone for the first collation of these Benefits, but also for their preservation and continuance. God preserves our Souls in Life, and defends us from Dangers and sad Accidents, which do so beset us on every side, that the greatest circumspection in the World could not secure us, did not his good Providence continually watch over us. We may be said to walk and converse in the midst of Snares; besides, did we but duly consider the Make and Frame of our Bodies, what a multitude of minute Parts and Vessels there are in them, and how an Obstruction in one redounds to the prejudice of the whole,

we could not but wonder how ſo curious an Engine as mans Body, could be kept in Tune one Hour, as we uſe it, much leſs hold out ſo many Years: How it were poſſible it ſhould endure ſuch hardſhip, ſuch blows, ſo many ſhocks and concuſſions, nay ſuch violences and outrages as are offered it by our frequent Exceſſes, and not be diſordered and rendred uſeleſs; and acknowledg the tranſcendent Art and Skill of Him who ſo put it together, as to render it thus firm and durable.

Infer. 2. Secondly, Did God make the Body, let him have the ſervice of it. *Rom.* 12. 1. *I beſeech you, brethren, by the mercies of God, that you preſent your Bodies a living Sacrifice, holy, acceptable unto God, which is your reaſonable ſervice.* 1 Cor. 6. 20. *Glorifie God in your Body, or with your Body, and in your ſpirits, which are Gods,* and that not by Redemption only, of which the Apoſtle there ſpeaks, but by Creation alſo. *Rom.* 6. 13. *Neither yield ye your members as inſtruments of unrighteouſneſs unto ſin, but as inſtruments of righteouſneſs unto God.* And again *Ver.* 19. *Even ſo now yield your members ſervants of righteouſneſs unto holineſs.* I ſhall inſtance in two Members, which are eſpecially to be guarded and reſtrained from Evil, and employed in the ſervice of God,

First,

First, The *Eye*. We must *turn away our eyes from beholding Vanity*, as *David* pray'd, God would his, *Psal.* 119. 37. We must *make a Covenant with our Eyes*, as *Job* did, *Job* 31. 1. These are the Windows that let in exteriour Objects to the Soul: by these the Heart is affected: this way Sin entred first into the World. Our first Parents saw that *the Tree* and its fruit *was pleasant to the eyes*, and so was invited to take and eat it. There are four sins especially for which the Eye is noted, as either discovering themselves in the Eyes, or whose Temptations enter in by, and so give denomination to the Eye.

2. There is a *proud Eye*. Prov. 30. 13. *There is a generation, O how lofty are their eyes, and their eye-lids are lifted up.* Chap. 6. 17. *A proud look* is reckoned the first of those six things that God hates, *Psal.* 18. 27. *God* (the Psalmist saith) *will bring down* proud or *high looks*. Psalm 101. 5. *Him that hath a high look and a proud heart* (saith *David*,) *I will not suffer*. And in *Psal.* 131. 1. He saith of himself, that *his heart is not haughty nor his eyes lofty*. By which places it appeareth that Pride sheweth forth it self in the Eyes especially, and that they are as it were the Seat or Throne of it.

2. There

2. There is a *wanton* Eye, which the Prophet *Iſaiah* ſpeaks of in his third Chapter, at the 16th Verſe, *Becauſe the Daughters of* Jeruſalem *walk with ſtretched-out Necks, and wanton Eyes.* The Apoſtle *Peter* in his ſecond Epiſtle, 2. 24. mentions *Eyes full of Adultery.* For by theſe Caſements enter in ſuch Objects as may provoke and ſtir up adulterous Thoughts in the mind, as they did in *David*'s, and likewiſe impure Thoughts conceived in the heart may diſcover themſelves by the motions of the Eye. And therefore in this reſpect we ſhould do well with holy *Job*, to make a Covenant with our Eyes; not to gaze upon any Object which may tempt us to any inordinate Appetite or Deſire. For our Saviour tells us, it were better to pluck out our right eye, than that it ſhould be an offence to us: which I ſuppoſe refers to this matter, becauſe it immediately follows thoſe words, *He that looketh upon a Woman to luſt after her hath already committed Adultery with her in his heart.*

3. There is a *covetous Eye.* By Covetouſneſs I underſtand not only a deſiring what is another mans, which is forbidden in the tenth Commandment, but alſo an inordinate deſire of Riches, which the Apoſtle *John* ſeems to underſtand in his firſt Epiſtle, 2. 16. By *the luſt of the Eye.* And Covetouſneſs

touſneſs may well be called the *luſt of the Eye*, becauſe 1. The Temptation or tempting Object enters by the Eye. So the ſeeing the wedg of Gold and Babyloniſh Garment ſtirred up the covetous deſire in *Achan*. 2. Becauſe all the fruit a man reaps of Riches more than will furniſh his Neceſſities and Conveniencies, is the feeding of his Eye, or the pleaſure he takes in the beholding of them. *Eccleſ.* 5. 11. *When goods encreaſe*, &c. *what good is there to the owners thereof, ſaving the beholding them with their Eyes?*

Fourthly, There is an *envious* Eye, which by our Saviour is called an evil Eye. *Mat.* 20. 15: *Is thine Eye evil becauſe I am good.* That is, envieſt thou thy Brother becauſe I am kind to him. And 7. 22. One of thoſe evil things which proceed out of the Heart and defile a Man is *an evil eye.* Envy is a repining at the Proſperity or Good of another, or anger and diſpleaſure at any good of another which we want, or any advantage another hath above us: As in the Parable of the Labourers in the Vineyard, thoſe that came in firſt envied the laſt, not becauſe they received more than they, but becauſe they received equal wages for leſs time. Thoſe that are ſubject to this Vice cannot endure to ſee another man thrive; and are apt to think his condition better than theirs when indeed it is not.

Let

Let us then so govern our Eyes, that we discover by them none of these Vices. Let the humility and purity of our Minds appear even in our outward looks. Let neither Pride nor Lust manifest themselves in the Posture or Motions of our Eyes. Let us have a care that these Members be neither the inlets, nor outlets of any of the fore-mentioned Vices; that they neither give admission to the Temptation, nor be expressive of the Conception of them. Let us employ them in reading the Word of God, and other good Books, for the encrease of our Knowledg, and direction of our Practice: in diligently viewing and contemplating the Works of the Creation, that we may discern and admire the Footsteps of the Divine Wisdom easily to be traced in the Formation, Disposition, and Designations of them. Let us take notice of any extraordinary Events and Effects of Gods Providence towards our selves or others, personal or national: that as they are the issues of his Mercy or Justice, they may stir up sutable affections in us, of Thankfulness or Fear. Let those sad and miserable Objects, that present themselves to our sight move us to pity and commiseration: And let our Eyes sometimes be exercised in weeping for the miseries and calamities of others, but especially for our own and their Sins.

Secondly,

Secondly, Another Member I ſhall mention is the *Tongue*, which as it is the chief Inſtrument of Speech, ſo may it be well or ill employed in the exerciſe of that Action, and therefore ſtands in need of Direction and Reſtraint. I remember I once heard from an ingenious *Anatomiſt* of *Padua* this Obſervation, That there are but two Members in the Body that have a natural Bridle, both which do very much need it; the Tongue, and another I ſhall not name. The ſignification whereof may be, that they are not to be let looſe, but diligently curbed and held in. For the better Government of the Tongue, I ſhall note ſome Vices of Speech, which muſt carefully be avoided. Firſt of all *Loquacity* or *Garrulity*. This the contrivance of our Mouths ſuggeſts to us. Our Tongues are fenced and guarded with a double Wall or Mound of Lips and Teeth, that our Words might not raſhly and unadviſedly ſlip out. Then Nature hath furniſhed us with two Ears, and but one Tongue, to intimate that we muſt hear twice ſo much as we ſpeak. Why Loquacity is to be avoided, the wiſe Man gives us a ſufficient reaſon, *Prov.* 10. 19. *In the multitude of words there wanteth not ſin.* And *Eccleſ.* 5. 7. *In many words there are divers vanities.* To which we may add another, of great force

with

with most Men, *viz.* That it hath been always esteemed an Effect and Argument of Folly. *Eccles.* 5. 3. *A fools voice is known by multitude of words.* And on the contrary, To be of few Words is a sign of Wisdom: and he that is wise enough to be silent, though a Fool, may pass undiscovered. Besides all this, a talkative Person must needs be impertinent, and speak many idle Words, and so render himself burthensom and odious to Company: and may perchance run himself upon great incoveniences, by blabbing out his own or others secrets; for a word once uttered, *fugit irrevocabile*, whatever the consequence of it be. Great need therefore have we to set a watch over our Mouths, and to keep the Door of our Lips; and not suffer our Tongues * προτρέχειν τῆς διανοίας; as *Isocrates* phraseth it.

* *runs before the Understanding or Wit.*

Secondly, Lying or False Speaking. There is difference between *Mentiri* and *Mendacium dicere*, that is Lying, and speaking of an untruth, or thing that is False. *Mentiri* is *contra mentem ire*, which though it be no good Etymology of the Word, is a good Notion of the Thing; that is, to go against ones Mind, or speak what one does not think. ἕτερον μὲν κεύθειν ἐν φρεσὶν, ἄλλο δὲ βάζειν, as *Homer* expresseth it, to conceal one thing in the Mind, and speak another with the Tongue.

Tongue. Hence a Man may Speak an untruth, and yet not Lye, when, he thinks he ſpeaks the Truth; and on the contrary, may ſpeak what is materially True, and yet Lye, when he ſpeaks what he thinks not to be true. The Tongue was made to be the *Index* of the Mind, Speech the Interpreter of Thought; therefore there ought to be a perfect Harmony and Agreement between theſe two. So that Lying is a great abuſe of Speech, and a perverting the very end of it, which was to communicate our Thoughts one to another. It hath alſo an ill Principle for the moſt part, proceeding either from *baſeneſs of Spirit or Cowardiſe*, as in them that have committed a fault, and deny it, for fear of Puniſhment or Rebuke: or from *Covetouſneſs*, as in Tradeſmen who falſly commend their Commodities, that they may vend them for a greater Price; or from *Vanity* and *vain Glory*, in them who falſly boaſt of any Quality or Action of their own. It is odious both to God and Man. To God, *Prov.* 6. 17. *A lying tongue* is one of thoſe ſix or ſeven things that are an *abomination to him.* To Men, as *Homer* witneſſeth in the verſe preceding the fore-quoted.

Ἐχθρὸς γάρ μοι κεῖνος ὁμῶς Ἀΐδαο πύλῃσι, &c.

He

He that tells Lies is as hateful to me as the Gates of Hell or Death.—The Practice of Lying is a Diabolical Exercise, and they that use it are the Devils Children, as our Saviour tells us: *John* 8. 44. *Ye are of your father the Devil*, &c. *for he is a lyar, and the father of it.* And lastly, it is a Sin that excludes out of Heaven, and depresses the Soul into Hell. *Revel.* 21, 8. *All liars shall have their part in the lake which burns with fire and brimstone, which is the second death.*

Thirdly, Another Vice or Abuse of Speech, or vicious Action to which the Tongue is instrumental is *slandering*; that is raising a false Report of any Man tending to his Defamation. This might have been comprehended under the former head, being but a kind of Lying proceeding from enmity or ill will. It is a very great injury to our Neighbour, mens Reputation being as dear to them as Life itself; so that it is grown to be a Proverb among the Vulgar, *Take away my good Name and take away my Life.* And that which enhances this injury is that it is irreparable. We cannot by any contrary Declaration so clear the innocency of our Neighbour as wholly to extirpate the preconceived Opinion, out of the Minds of those to whom our confession comes; and many will remain whom the Calumny hath reacht,

reacht, to whom the vindication probably will not extend; the pravity of mans Nature being more apt to ſpread and divulge an ill Report than to ſtop and ſilence it. I might inſtance in Flattering of others, and boaſting of our ſelves for two abuſes of Speech, but they may both be referred to Lying, the one to pleaſe others, and puff them up with Self-Conceit, and a falſe Opinion that they have ſome excellent Quality or Endowment which they want, or have not in ſuch a Degree, or that they are better thought of by others than indeed they are, and more honored: The other to gain more honor than is due to them.

Fourthly, *Obſcene* and *impure Words* are another vicious Effect of the Tongue. Thoſe are principally the σαπροὶ λόγοι, rotten Speeches the Apoſtle ſpeaks of *Eph.* 5. 29. Such as chaſt Ears abhor, which tend only to the depraving and corrupting the hearers: and are to be ſtudiouſly and carefully avoided by all that pretend to Chriſtianity. *Epheſ.* 5, 3. *But fornication and all uncleanneſs let it not be once named among you.*

Fifthly, Curſing, and Railing or reviling Words are alſo a great abuſe of Speech, and outragious Effects and Expreſſions of Malice and Wickedneſs. *Pſalm.* 10. 7. The *Pſalmiſt* makes it part of the Character of a wicked

Man, that *His mouth is full of curſing*. Which paſſage we have quoted by the Apoſtle *Rom.* 3. 14. *Whoſe mouth is full of curſing and bitterneſs.*

Sixthly, Swearing and Irreverent uſing the Name of God in common Diſcourſe and Converſe, is another abuſe of the Tongue; to which I might add vehement Aſſeverations upon ſleight and trivial occaſions. I do not deny, but in a matter of Weight and Moment, which will bear out ſuch atteſtation, and where belief will not be obtained without them, and yet it may much import the Hearer or Speaker that his Words be believed, or where the hearer would not otherwiſe think the matter ſo momentous or important as indeed it is, Proteſtations and Aſſeverations, yea Oaths may Lawfully be uſed. But to call God to Witneſs to an Untruth or a Lye perhaps, or to appeal to Him on every trivial occaſion, in common Diſcourſe, cuſtomarily, without any conſideration of what we ſay, is one of the higheſt Indignities and Affronts that can be offered Him, being a Sin to which there is no Temptation: For it is ſo far from gaining Belief (which is the only thing that can with any ſhew of Reaſon be pleaded for it) that it rather creates diffidence and diſtruſt. For as *multa fidem promiſſa levant*, ſo *multa Juramenta*

ramenta too, it being become a Proverb *He that will Swear will Lie.* And good Reaſon there is for it; for he that ſcruples not the breach of one of Gods Commands, is not likely to make Conſcience of the violation of another.

Laſtly, For I will name no more, Scurrilous Words, Scoffing and Jeering, Flouting and Taunting, are to be cenſured as vicious Abuſes of Speech.

This Scoffing and Deriſion proceeds from Contempt, and that of all injuries Men do moſt impatiently bear; nothing offends more, or wounds deeper; and therefore what greater violation of that general Rule of Chriſtian Practice, *to do to others as we would they ſhould do unto us?* This injury of being Derided the *Pſalmiſt* himſelf complains of, *Pſalm* 69. 11, 12. *I became a proverb to them. They that ſit in the Gate ſpeak againſt me, and I was the ſong of the Drunkards.* And *Pſalm* 35. 15, according to the Church Tranſlation, *The very Abjects came together againſt me unawares, making mows at me, and ceaſed not.* and the Prophet *Jeremy*, *Jer.* 20. 7. *I am in deriſion daily, every one mocketh me.* And though there may be ſome Wit ſhewn in Scoffing and Jeſting upon others, yet is it a Practice inconſiſtent with true Wiſdom. The Scorner and the wiſe Man are frequently

poſed in Scripture. *Prov.* 9. 8. and Chap. 13. 1, *&c.* It is a Proverbial ſaying, *The greateſt Clerks are not always the wiſeſt men.* I think the ſaying might as often be verified of the greateſt *Wits.* Scorning in that Gradation in the firſt *Pſalm* is ſet down as the higheſt ſtep of Wickedneſs. And *Solomon* tells us *That judgments are prepared for the Scorners.*

You will ſay to me, how then muſt our Tongues be employed? I Anſwer, In Praiſes and Thankſgiving unto God. *Pſalm* 35.28. *And my tongue ſhall ſpeak of thy righteouſneſs and of thy praiſes all the day long.* Parallel whereto is *Verſ.* 24. of *Pſalm* 71. Indeed the Book of *Pſalms* is in a great meaſure but an Exerciſe of, or Exhortation to this Duty. 2. We muſt exerciſe our Tongues in Talking of all his wondrous Works. *Pſalm* 145. 5, 6. *I will ſpeak of the glorious honour of thy majeſty, and of thy wondrous works.* 3. In Prayer to God. 4. In Confeſſion of Him and of his Religion, and publickly owning it before Men, whatever the hazard be. 5. In Teaching, Inſtructing and Counſelling of others. 6. In Exhorting them. 7. In Comforting them that need it. 8. In Reproving them. All which Particulars I might enlarge upon; but becauſe they come in here only as they refer to the Tongue,

it

it may ſuffice to have mention'd them ſummarily.

Thirdly, Let us hence duly learn to prize and value our Souls; is the Body ſuch a rare Piece, what then is the Soul? the Body is but the Husk or Shell, the Soul is the Kernel; the Body is but the Cask, the Soul the precious Liquor contained in it; the Body is but the Cabinet, the Soul the Jewel; the Body is but the Ship or Veſſel, the Soul the Pilot; the Body is but the Tabernacle, and a poor Clay Tabernacle or Cottage, the Soul the Inhabitant; the Body is but the Machine or Engine, the Soul that ἐνδὼν ἐκ, that actuates and quickens it; the Body is but the dark Lanthorn, the Soul or Spirit is the Candle of the Lord that burns in it: And ſeeing there is ſuch difference between the Soul and the Body in reſpect of Excellency, ſurely our better Part challenges our greateſt care and diligence to make Proviſion for it. Bodily Proviſion is but half Proviſion, it is but for one Part of a Man, and that the meaner and more ignoble too, if we conſider only the time of this Life; but if we conſider a future Eſtate of endleſs duration after this Life, then Bodily Proviſion will appear to be, I do not ſay quarter Proviſion, but no Proviſion at all in compariſon, there being no proportion

between ſo ſhort a period of time, and the infinite Ages of Eternity. Let us not then be ſo fooliſh as to employ all our thoughts and beſtow all our time and pains about cheriſhing, accommodating and gratifying our Bodies, in *making Proviſion for the Fleſh to fulfill the Luſts thereof*, as the Apoſtle phraſeth it; and ſuffer our Souls to lie by neglected, in a miſerable, and poor, and blind, and naked condition. Some Philoſophers will not allow the Body to be an eſſential Part of Man, but only the Veſſel or Vehicle of the Soul; *Anima cujuſque eſt quiſque.* Though I would not be ſo unequal to it, yet I muſt needs acknowledg it to be but an inferior Part: it is therefore ſo to be treated, ſo dieted and provided as to render it moſt calm and compliant with the Soul, moſt tractable and obſequious to the dictates of Reaſon; not ſo pampered and indulged, as to encourage it to caſt its Rider, and to take the Reins into its own Hand, and uſurp Dominion over the better part, the τὸ ἡγεμονικὸν, to ſink and depreſs it into a ſordid compliance with its own Luſts, *Atque affigere humi Divinæ particulam auræ.*

This is our Duty, but alas what is our Practice? Our great partiality towards our Bodies, and neglect of our Souls, ſhews clearly

clearly which Part we prefer. We are careful enough of wounding or maiming our Bodies, but we make bold to laſh and wound our Souls daily; for every Sin we commit, being contrary to its Nature, is a real Stripe yea a mortal Wound to the Soul, and we ſhall find it to be ſo, if our Conſciences be once awakened to feel the Sting and Smart of it. We are induſtrious enough to preſerve our Bodies from Slavery and Thraldom, but we make nothing of ſuffering our Souls to be Slaves and Drudges to our Luſts, and to live in the vileſt Bondage to the moſt degenerate of Creatures, the Devil: We are thrifty and provident enough not to part with any thing that may be ſerviceable to our Bodies under a good conſideration, and we ſo eſteem them, as that we will part with all we have for the life of them; but we make little account of what is moſt beneficial to our Souls, the means of Grace and Salvation, the Word of God and Duties of his Worſhip and Service, nay we can be content to ſell our Souls themſelves for a Trifle, for a thing of nothing, yea for what is worſe than nothing, the ſatisfying of an inordinate and unreaſonable Appetite or Paſſion. We highly eſteem and ſtand much upon our Nobility, our Birth and Breeding, though we derive nothing

from our Ancestors but our Bodies and Corporeal Qualities; and it is useful so far to value and improve this Advantage, as to provoke us to imitate the good Examples of our Progenitors, not to degenerate from them, nor to do any thing unworthy of our Breeding; and yet the divine Original of our Souls, which are Beams from the Father of Lights, and the immediate Offspring of God himself, τὸ γὰρ ἐκ γένους ἐσμέν, hath little influence upon us to engage us to walk worthily of our extraction, and to do nothing that is base or ignoble, and unsutable to the Dignity of our Birth.

You will say, how shall we manifest our Care of our Souls? what shall we do for them? I answer, the same we do for our Bodies. 1. We feed our Bodies, our Souls are also to be fed: The Food of the Soul is Knowledg, especially knowledg in the Things of God, and the Things that concern its eternal Peace and Happiness; the Doctrine of Christianity, the Word of God read and preached, 1. *Pet.* 2. 2. *As new born Babes desire the sincere Milk of the Word that ye may grow thereby.* *Heb.* 5. 12. The Apostle speaks both of Milk and of strong Meat. Milk he there calls the Principles of the Doctrine of Christ, and again, 1. *Cor.* 2. 3. *I have fed you with Milk and*

not

not with Meat, for hitherto ye were not able to bear it. So we ſee in the Apoſtles phraſe, feeding of the Flock is teaching and inſtructing of them. Knowledg is the Foundation of Practice; it is impoſſible to do Gods Will before we know it; the Word muſt be received into an honeſt and good Heart and underſtood, before any Fruit can be brought forth.

Secondly, We heal and cure our Bodies, when they are inwardly Sick, or outwardly Harmed; Sin is the ſickneſs of the Soul, *Matth.* 9. 12. *They that be whole need not a Phyſitian, but they that be Sick,* ſaith our Saviour, by way of Similitude, which he explains in the next Verſe, *I am not come to call the Righteous but Sinners to Repentance.* For the cure of this Diſeaſe an humble, ſerious, hearty Repentance is the only Phyſick; not to expiate the Guilt of it, but to qualifie us to partake of the benefit of that Atonement which our Saviour Chriſt hath made, by the ſacrifice of himſelf, and reſtore us to the Favor of God, which we had forfeited, it being as much as in us lies an undoing again what we have done.

Thirdly, We cloth and adorn our Bodies, our Souls alſo are to be clothed with holy and vertuous Habits, and adorned with good Works. 1. *Pet.* 5. 5. *Be ye clothed*

with

with Humility; and in the ſame Epiſtle, *Chap.* 2. 3. he exhorts Women to *adorn themſelves, not with that outward adorning of plaiting the Hair, and of wearing* Gold, &c. but with the *Ornament of a meek and a quiet Spirit, which is in the Sight of God of great price.* And in *Revel.* 19. 8. *The righteouſneſs of the Saints* is called *fine linnen.* And the Saints are ſaid to be *clothed in white raiment.* Matt. 23. 11. Works of Righteouſneſs, and a Converſation becoming the Goſpel is called a *wedding garment.* *Coloſſ.* 3. 10. *Put on the new man.* And again, *Put on therefore as the Elect of God bowels of mercy, meekneſs,* &c. On the contrary vicious Habits and ſinful Actions are compared to filthy Garments. So *Zechar.* 3. 3. *Joſhua* the High-Prieſt is ſaid to be *clothed with filthy garments*; which in the next Verſe are Interpreted his Iniquities either Perſonal or of the People, whom he Repreſented, *I have cauſed thy iniquity to paſs from thee, and will cloth thee with change of raiment.*

Fourthly, We Arm and Defend our Bodies. And our Souls have as much need of Armour as they: For the Life of a Chriſtian is a continual Warfare; and we have potent and vigilant Enemies to encounter withal; the Devil, the World and this corrupt Fleſh we carry about with us. We had

had need therefore to take to us the Chriſtian Panoply, to *Put on the whole armour of God, that we may withſtand in the evil day, and having done all may ſtand; having our loyns girt with truth, and having the breaſt-plate of righteouſneſs, and our feet ſhod with the preparation of the Goſpel of peace. Above all taking the ſhield of faith, and for an helmet the hope of Salvation, and the ſword of the ſpirit, which is the word of God.* Epheſ. 6. 13, 14, &c.

He that with his Chriſtian Armour manfully Fights againſt and Repels the Temptations and Aſſaults of his Spiritual Enemies. He that keeps his Garments pure, and his Conſcience void of Offence towards God and towards Man, ſhall enjoy perfect Peace here, and Aſſurance for Ever. *Tacitus* ſaith of the *Finni*, a Northern People, that they were *ſecuri adverſus homines, ſecuri adverſus Deos.* They need not fear what God or Man could do to them, becauſe they were in as bad a condition as could conſiſt with living in the World: They could not be Baniſhed into a worſe Country, nor put into worſe circumſtances than they were in already. I might ſay of the Man that keeps a good Conſcience, that he is ſecure againſt God and Man; not in that Senſe the *Finni* were; but ſecure of any Evil befalling him, from either.

God

God can do him no harm, not for want of Power, but for want of Will, which is regulated by his Truth and Juſtice. He is alſo ſecure in reſpect of Men, becauſe he is under the Protection of the Almighty: and if any there be that would do him harm, they ſhall either be reſtrained by the Divine Providence, or if they be permitted to injure him, it ſhall tend only to the exerciſe and improvement of his Faith and Patience, and enhancing his future Reward at that great Day, when the Almighty ſhall diſpenſe *Aureolæ* to thoſe Champions who have ſignalized their Valour and Fidelity by heroick Actions, or patient Sufferings of unworthy things for his Sake. 3. A good Conſcience not only ſecures a Man from God and Men, but from himſelf too. *There is no peace to the wicked*, ſaith my God, no inward Peace. Such a Man is at odds with himſelf. For the Commandments of God being agreeable to the Nature of Man, and perfectly conformable to the Dictates of right Reaſon; mans Judgment gives Sentence with the Divine Law, and condemns him when he violates any of them; and ſo the Sinner becomes an *Heautontimorumenos*, a Tormenter of himſelf. *Prima eſt hæc ultio, quod ſe Judice nemo nocens abſolvitur.* No guilty Perſon is Abſolved at his own Tribunal, himſelf being Judge. Nei-

Neither let any profligate Perſon, who hath bidden Defiance to his Conſcience, and is at War with himſelf, think to take Sanctuary in Atheiſm, and becauſe it imports him highly there ſhould be no God, ſtoutly deny that there is any. For Firſt, ſuppoſing that the Exiſtence of a Deity were not demonſtrably or infallibly Proved, (as it moſt certainly is) yet he cannot be ſure of the contrary, that there is none. 'For 'no Man can be ſure of a *pure Negative*, 'namely that ſuch a thing is not, unleſs he 'will either pretend to have a certain know-'ledg of all Things that are or may be, 'than which nothing can be more mon-'ſtrouſly and ridiculouſly Arrogant; or elſe 'unleſs he be ſure that the Being of what he 'denies doth imply a contradiction; for 'which there is not the leaſt Colour in this 'Caſe. The true Notion of God conſiſt-'ing in this, *That he is a Being of all poſ-ſible perfection.* That I may borrow my Lord Biſhop of *Cheſters* Words in his Diſcourſe of Natural Religion, *Pag.* 94.

Now if he be not ſure there is no Deity, he cannot be without ſome ſuſpicion and fear that there may be one.

'Secondly, If there ſhould be a Deity, , ſo Holy and Juſt and Powerful as is ſup-'poſed, what Vengeance and Indignation may

'may ſuch vile Miſcreants and Rebels ex-
'pect, who have made it their buſineſs to
'baniſh *Him* out of the World who is the
'Great Creatour and Governour of it, to
'undermine his Being, and Eradicate all No-
'tions of Him out of their own and o-
'ther mens Minds; to provoke his Crea-
'tures and Vaſſals to a Contempt of Him,
'a ſleighting of his Fear and Worſhip, as
'being but ſuch imaginary *Chimæra's*, as
'are fit only to keep Fools in awe. Cer-
'tainly as this is the higheſt provocation
'that any Man can be guilty of, ſo ſhall
'it be Puniſhed with the ſoreſt Vengeance.

Now a ſlender ſuſpicion of the Exiſtence of a Being, the denial whereof is of ſo ſad conſequence, muſt needs diſturb the Atheiſts Thoughts, and fill him with fears, and qualifie and allay all his Pleaſures and Enjoyments, and render him miſerable even in this Life.

'But on the other ſide, he that believes
'and owns a God; if there ſhould be none,
'is in no danger of any bad conſequent.
'For all the inconvenience of this Belief will
'be, that he may be hereby occaſioned to
'tye himſelf up to ſome needleſs reſtraints
'during this ſhort time of his Life, where-
'in notwithſtanding there is, as to the *pre-*
'*ſent*, much Peace, Quiet, and Safety; And,

'as

'as to the *future*, his errour ſhall die with 'him, there being none to call him to an 'Account for his miſtake. Thus far the Biſhop. To which I ſhall add, that he not only ſuffers no damage, but reaps a conſiderable benefit from this miſtake; for during this Life he enjoys a pleaſant Dream or Fancy of a future bleſſed Eſtate, with the Thoughts and Expectation whereof he ſolaces himſelf, and agreeably entertains his time; and is in no danger of being ever awakened out of it, and convinced of his Errour and Folly, Death making a full end of him.

FINIS.

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